Overview Environmental Assessment
for the
Space Based Infrared System (SBIRS)

Prepared for

Department of the Air Force
Headquarters Space and Missile Systems Center
Los Angeles Air Force Base, California
and
Armstrong Laboratory
Occupational and Environmental Health Directorate
Brooks Air Force Base, Texas

December 1996

Contract F41624-95-D-9018, Order 0013
C Printed on Recycled Paper

Report Documentation Page

Report Date	Report Type	Dates Covered (from... to)
00121996	N/A	-

Title and Subtitle Overview Environmental Assessment for the Space Based Infrared System (SBIRS)	**Contract Number** F41624-95-D-9018
	Grant Number
	Program Element Number
Author(s)	**Project Number**
	Task Number
	Work Unit Number
Performing Organization Name(s) and Address(es) Parsons Engineering Science 8000 Centre Park Drive, Suite 200 Austin, Texas 78754	**Performing Organization Report Number**
Sponsoring/Monitoring Agency Name(s) and Address(es) Department of the Air Force Headquarters Space and Missile Systems Center Los Angeles AFB, CA 90245 Armstrong Laboratory Occupational and Environmental Health Directorate Brooks AFB, Texas	**Sponsor/Monitor's Acronym(s)** USAF SMC
	Sponsor/Monitor's Report Number(s)
Distribution/Availability Statement Approved for public release, distribution unlimited	
Supplementary Notes	
Abstract	
Subject Terms	
Report Classification unclassified	**Classification of this page** unclassified
Classification of Abstract unclassified	**Limitation of Abstract** UU
Number of Pages 120	

FINDING OF NO SIGNIFICANT IMPACT

SPACE BASED INFRARED SYSTEM (SBIRS)

Agency: United States Air Force (USAF), Air Force Materiel Command, Headquarters Space and Missile Systems Center (HQ SMC).

Cooperating Agencies: Air Force Space Command; Patrick Air Force Base, Florida.

Background: Pursuant to the National Environmental Policy Act (NEPA), the Council on Environmental Quality (CEQ) regulations implementing the Act (40 CFR 1500-1508), Air Force Instruction (AFI) 32-7061, which implements these regulations in the environmental impact analysis process (EIAP), and other applicable federal and local regulations, the U.S. Air Force has conducted an overview environmental assessment (OEA) of the potential environmental consequences of the Space Based Infrared System (SBIRS) program. An OEA was necessitated by the fast track acquisition reform process this program is on. At this time in the process, there are too many unknowns in site locations and final design details to prepare a specific NEPA document. Based on similar satellite system acquisitions and known launch system impacts, it was decided that there was minimum risk in this approach.

Proposed Action: The proposed action for this phase of the acquisition which is the SBIRS High component, which is development and testing of the satellites for the geosynchronous orbit, development and testing of the infrared sensors for the highly elliptical orbit, design and testing of the antennas for the overall SBIRS program, and Atlas IIAS or Evolved Expendable Launch Vehicle (EELV) operations at Cape Canaveral Air Station, Florida. Related future SBIRS actions will be decided based upon site specific environmental assessments for those actions.

No Action Alternative: The no action alternative would be continued reliance on the Defense Support Program system with consolidated ground processing functions until the satellites reach the end of their operational life.

Summary of Findings: The OEA evaluated the potential environmental effects associated with various components of the SBIRS program. Analyses indicated that no significant impacts will occur for any of these components. Summaries of anticipated environmental impacts are included in Tables 1 through 2 of the attached OEA. Major impacts identified are as follows:

Global Impacts: Global impacts consist of launch vehicle impacts to the stratospheric ozone layer from rocket exhaust and deorbiting debris. These were found to be insignificant compared to the total worldwide anthropogenic contributions.

Regional Impacts: There are no significant environmental impacts associated with this program.

Local Impacts: Local impacts consist of the launch clouds from the launch vehicles, electromagnetic radiation from antennas and local spills from prelaunch activities. Launch cloud depositions and impacts are not significant. Electromagnetic radiation from antennas are mitigated by operational constraints and safety procedures and are determined to be insignificant. Local spills are handled by proven base operational procedures and are identified in the attached OEA. Ground support facilities will be located at installations with similar facilities in previously disturbed areas. Prior NEPA analysis has shown that such facilities typically do not have significant impacts.

Conclusion: Following a review of the attached overview environmental assessment, which is hereby incorporated by reference, I find that the Space Based Infrared System program will not produce significant environmental impacts, and an environmental impact statement is not required. This document, and the supporting environmental assessment, fulfill the requirements of NEPA, the CEQ regulations, and AFI 32-7061.

Approved:

______________________________ ____________________

JOHN L. CLAY Date
COLONEL USAF
HQ Space and Missile Systems Center
Chairperson, Environmental Protection Committee

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ACRONYMS AND ABBREVIATIONS

°F	Degrees Fahrenheit
$\mu g/m^3$	Micrograms per cubic meter
45 CES/CEV	45 SW Environmental Planning Function
45 SW	45th Space Wing
ACHP	Advisory Council on Historic Preservation
AFB	Air Force Base
AFI	Air Force Instruction
AFOSH	Air Force Occupational Safety and Health
AFSCN	Air Force Satellite Control Network
AFSPC	Air Force Space Command
AICUZ	Air Installation Compatible Use Zone
$AlCl_x$	Aluminum chlorides
Al_2O_3	Aluminum oxide
ALERT	Attack and Launch Early Reporting to Theater
ANGB	Air National Guard Base
ANSI	American National Standards Institute
AQCR	Air Quality Control Region
AS	Air Station
AST	Aboveground storage tank
CAA	Clean Air Act
CAAA	Clean Air Act Amendments
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CES	Civil Engineering Squadron
CFC	Chlorofluorocarbons
CFR	Code of Federal Regulations
Cl	Chlorine
cm	centimeter
CMAH	Commander-in-Chief Mobile Alternate Headquarters
CMP	Coastal Management Program

CO	Carbon monoxide
CO_2	Carbon dioxide
CY	Calendar year
CZMA	Coastal Zone Management Act
dB	Decibels
dBA	Decibels A-weighted average
DF2	Diesel fuel, No. 2
DoD	Department of Defense
DOT	Department of Transportation
DPF	DSCS Processing Facility
DRMO	Defense Reutilization and Marketing Office
DSCS	Defense Satellite Communications System
DSP	Defense Support Program
EA	Environmental assessment
EEGL	Emergency Exposure Guidance Level
EELV	Evolved Expendable Launch Vehicle
EIAP	Environmental impact analysis process
EIS	Environmental impact statement
EO	Executive Order
EPA-17	USEPA priority pollutant list of 17 industrial toxics
EPCRA	Emergency Planning and Community Right-to-Know Act
ESA	Endangered Species Act
EVCF	Eastern Vehicle Checkout Facility
FAC	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FGFWFC	Florida Game and Fresh Water Fish Commission
FIP	Federal Implementation Plan
FONSI	Finding of No Significant Impact
FPL	Florida Power and Light
FR	Federal Register
FSA	Fuel Storage Area
ft^2	Square feet
FY	Fiscal year
GEO	Geosynchronous Earth orbit
H_2O	Water

HBFC	Hydrobromofluorocarbon
HCFC	Hydrochlorofluorocarbon
HCl	Hydrogen chloride
HEO	Highly Elliptical Orbit
HQ	Headquarters
HSWA	Hazardous and Solid Waste Amendments
HUD	Housing and Urban Development
HWMP	Hazardous Waste Management Plan
IDLH	Immediately Dangerous to Life or Health
ILUMP	Integrated Land Use Management Plan
IPA	Isopropyl alcohol
IR	Infrared
IRP	Installation Restoration Program
JPC	Joint Propellants Contractor
JTAGS	Joint Tactical Ground Station
kg	kilogram
kV	Kilovolt
kVA	Kilovolt-ampere
kW	Kilowatt
kWh	Kilowatt-hour
lb	Pound
LBSC	Launch Base Support Contractor
LC_{50}	Concentration of a constituent at which 50 percent mortality of test animals occurs
L_{dn}	Day-night average sound level
LEO	Low Earth orbit
L_{eq}	24-hour energy equivalent sound level
L_p	Sound pressure
LPS	Large Processing Station
LV	Launch vehicle
MAC	Maximum Acceptable Concentration
m^2	square meter
MCCC	Mobile Consolidated Control Center
MCS	Mission Control Station
MCS-B	Mission Control Station Backup

MEO	Medium Earth orbit
mgd	million gallons per day
MHz	Megahertz
mm	millimeter
MMBtu	Million British thermal units
MMH	Monomethyl hydrazine
MPE	Maximum Permissible Exposure
MSDS	Material Safety Data Sheet
MW	megawatt
mW/cm^2	milliwatts per square centimeter
N_2	Nitrogen
N_2O	Nitrous oxide
NAAQS	National Ambient Air Quality Standards
NASA	National Aeronautics and Space Administration
NEPA	National Environmental Policy Act
nm	nanometer
NO_2	Nitrogen Dioxide
NOI	Notice of Intent
NO_x	Nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
NTF	National Test Facility
NTL	No Threat Level
O_3	Ozone
ODP	Ozone depleting potential
ODS	Ozone depleting substance
OFW	Outstanding Florida Water
OPlan	Operations Plan
OSHA	Occupational Safety and Health Administration
P2 MAP	Pollution Prevention Management Action Plan
Pb	Lead
PEL	Permissible exposure limit
PM_{10}	Particulate matter 10 microns and smaller
POL	Petroleum, oil, and lubricant
ppm	Parts per million

PPMP	Pollution Prevention Management Plan
PPP	Pollution prevention program
PSF	Propellant Servicing Facility
PSCo	Public Service Company of Colorado
RCRA	Resource Conservation and Recovery Act
REEDM	Rocket Exhaust Effluent Dispersion Model
RF	Radio frequency
RGS	Relay Ground Station
RP-1	Rocket Propellant 1
RT	Relocatable terminal
SAB	Satellite Assembly Building
SAMP	System Acquisition Management Plan
SARA	Superfund Amendments and Reauthorization Act
SBIRS	Space Based Infrared System
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SLBM	Submarine Launched Ballistic Missile
SMC	Space and Missile Systems Center
SMTS	Space and Missile Tracking System
SO_2	Sulfur Dioxide
SO_x	Sulfur Oxides
SPEGL	Short-term Public Emergency Guidance Level
SPIF	Spacecraft Processing and Integration Facility
SPRP	Spill Prevention and Response Plan
SRM	Solid rocket motor
SRMU	Solid Rocket Motor Upgrade
STEL	Short Term Exposure Limit
SW	Space Wing
TACDAR	Tactical Detection and Reporting
TLV	Threshold Limit Value
tpy	Tons per year
TSP	Total suspended particulate
TVCF	Transportable Vehicle Checkout Facility
UPS	Uninterruptible Power Supply
U.S.	United States

USAF	United States Air Force
USC	United States Code
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
UV	Ultraviolet
VOC	Volatile organic compound
yd^3	Cubic yard

SECTION 1

PURPOSE OF AND NEED FOR THE ACTION

This section has five parts: background information, a statement of the purpose of and need for the action, a statement of the decision to be made, the scope of the environmental impact analysis process (EIAP), and a description of the organization of the environmental assessment (EA).

1.1 BACKGROUND

A number of different missile warning, defense, and battlespace characterization systems are currently in use by the Department of Defense (DoD) and other national users. These systems include the Defense Support Program (DSP), the Large Processing Station (LPS), Attack and Launch Early Reporting to Theater (ALERT), Tactical Detection and Reporting (TACDAR), and Joint Tactical Ground Station (JTAGS). The DoD, under the auspices of the Air Force, proposes to integrate and ultimately replace these systems with the Space Based Infrared System (SBIRS). SBIRS would be the sole national and DoD overhead non-imaging infrared satellite system. An overview EA is needed to fulfill the EIAP requirements for the program. This overview EA will assist the Air Force decisionmaker(s) in determining whether to proceed with the SBIRS program. Future actions to implement the SBIRS program which are not known in sufficient detail or for support equipment locations which have not been determined at this phase in the acquisition process will be decided based upon future site-specific EAs for those actions as that information becomes available.

1.2 PURPOSE OF AND NEED FOR ACTION

The United States needs to procure a consolidated, cost-effective, flexible system that will meet the United States infrared space surveillance needs through the next two to three decades. The system must fulfill four broad mission areas: missile warning, missile defense, technical intelligence, and battlespace characterization. Missile warning includes the provision of timely, unambiguous, and accurate missile warning information at a global and theater level. Missile defense includes the provision of reliable, accurate, and timely information to ballistic missile defense systems. Technical intelligence includes the provision of reliable, accurate, and timely data to intelligence users to support strategic,

theater, and battlefield commanders with necessary tactical weapon performance and intelligence information. Battlespace characterization includes maintaining constant global surveillance for provision of air and space launch indications and timely warning to theater commanders. Furthermore, the system must be cost effective, minimize personnel requirements, and eliminate dependence on overseas processing of information.

The existing DSP satellite constellation and associated ground processing functions perform well for the threats they were designed to detect. However, a number of deficiencies exist with regard to these systems' ability to address potential and evolving new threats, and with regard to operational costs. The existing DSP system is aging, cannot provide timely interpretation of data associated with potential missile launches, has high operations and maintenance costs, and is dependent upon large overseas mission processing facilities to perform its mission. A new system is needed to cost effectively address potential and evolving new threats without dependence on overseas processing stations.

1.3 THE DECISION TO BE MADE

The decision to be made is whether to:

- Proceed with the proposed action for this phase of the acquisition which is the SBIRS High component, which is development and testing of the satellites for the geosynchronous orbit, development and testing of the infrared sensors for the highly elliptical orbit, design and testing of the antennas for the overall SBIRS program, and Atlas IIAS or Evolved Expendable Launch Vehicle (EELV) operations at Cape Canaveral Air Station, Florida. Related future SBIRS actions will be decided based upon site specific environmental assessments for those actions.
- Take no action (no action alternative).

1.4 SCOPE OF THE OVERVIEW ENVIRONMENTAL ASSESSMENT

Federal agencies are required to take into consideration the environmental consequences of proposed actions in the decision-making process under the National Environmental Policy Act (NEPA) of 1969. The intent of NEPA is to protect, restore, or enhance the environment through well-informed federal decisions. The Council on Environmental Quality (CEQ) was established under NEPA to implement and oversee federal policy in this process. The CEQ issued regulations implementing the process (40 CFR 1500-1508, 1978). The CEQ regulations require that an EA:

- Briefly provide evidence and analysis to determine whether the proposed action might have significant effects that would require preparation of an environmental impact statement (EIS). If the analysis determines that the environmental effects

will not be significant, a Finding of No Significant Impact (FONSI) will be prepared.

- Facilitate the preparation of an EIS, when required.

This EA is part of the EIAP for the proposed project as set forth in Air Force Instruction (AFI) 32-7061, which implements NEPA, CEQ regulations, and DoD Directive 6050.1. Generally, site specific and detailed information is not available for the proposed and alternative action, or is subject to change. Therefore, this EA provides environmental analysis at an overview level.

This overview EA identifies, describes, and evaluates the potential environmental impacts that could result from implementing the SBIRS program under the proposed or alternative action at government installations, as well as possible cumulative effects from other actions planned for these installations. It also identifies potential required environmental permits relevant to the proposed and alternative action. As appropriate, the affected environment and environmental consequences of the action may be described in terms of a regional overview or a site-specific description. Finally, the EA identifies mitigation measures to prevent or minimize environmental impacts.

The SBIRS program has a number of different components which can be divided into a ground segment and a space segment. The ground segment includes a number of ground-based facilities that would be located at various locations in the U.S. and the world. At this point, the possible locations and characteristics of the facilities that would comprise the ground segment have not been determined. Therefore, this EA will describe probable characteristics of these facilities and associated personnel apart from a specific location. Additional EIAP documentation that tiers from this EA will be necessary prior to a commitment to construction. No significant impacts are expected based upon experiences with similar programs and ground stations, although an individual determination will be made for site specific impacts.

The space segment would include three satellite constellations: DSP, geosynchronous Earth orbit (GEO), and highly elliptical orbit (HEO). The DSP constellation is an existing constellation. The latest acquisition of DSP satellites has been assessed in an EA with a signed FONSI (USAF, 1993a), and the Titan IV launch vehicle for these satellites has been assessed in an EA with a signed FONSI (USAF, 1990). These EAs are hereby incorporated by reference. Further analysis is not considered necessary.

The GEO satellite constellation would include four operational satellites launched from Cape Canaveral Air Station (AS), Florida. Specific attributes of these satellites have not been determined, nor the location and techniques used for prelaunch processing. An

analysis of probable environmental impacts associated with prelaunch processing of these satellites is included in this EA.

The HEO constellation will not be comprised of satellites per se, but will be extra payloads carried on other satellites. The program entity responsible for deployment of these satellites will be responsible for NEPA analysis for the satellites and the attached HEO payload, launch vehicle, and prelaunch processing operations.

The baseline launch vehicle (LV) for the GEO satellite constellation is the Atlas IIAS, which is a medium launch vehicle. The Atlas IIAS is the current launch vehicle best suited to carrying this size payload but it may be replaced by the EELV. If the EELV is chosen to substitute for the current launch system, that decision is independent of this action and will be assessed separately in another EIAP.

In summary, this overview EA will address anticipated impacts associated with the SBIRS High Component. This is an action independent of the SBIRS Low Component. Environmental attributes considered include air quality, water resources, solid waste, hazardous materials, hazardous waste, pollution prevention, nonionizing radiation, utilities, land use, noise, cultural resources, biological resources, health and safety, stratospheric ozone, and geosynchronous Earth orbit.

1.5 ORGANIZATION OF THE ENVIRONMENTAL ASSESSMENT

This EA comprises eight major sections. Section 1 contains an introduction and a description of the purpose and need for the proposed action. Section 2 describes the proposed action, summarizes the scope of this EA, describes alternatives to the proposed action, summarizes the environmental impacts of the alternatives, and identifies required permits. Section 3 presents information on the affected environment, providing a basis for analyzing the impacts of the proposed action and alternatives. Section 4 is an analysis of the environmental consequences. Section 5 addresses regulatory requirements and lists the relevant laws that pertain to the proposed action. Section 6 lists persons and agencies consulted in the preparation of this EA. Section 7 is a list of source documents relevant to the preparation of the EA. Section 8 lists preparers of this document. Appendix A contains the Air Force Form 813 for the project and Appendix B contains a copy of the Cape Canaveral AS light management plan.

SECTION 2

DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

This section has five parts: an overview of the SBIRS program which is the proposed action, description of the no action alternative, discussion of alternatives eliminated from further consideration, listing of potential required permits or consultation, and a summary of environmental impacts.

2.1 DESCRIPTION OF THE PROPOSED ACTION

A graphic overview of the SBIRS program is shown in Figure 1. The SBIRS program can generally be divided into a ground segment and a space segment.

The ground segment would include a mission control station, a mission control station backup, a survivable mission control station backup, relocatable terminals, and relay ground stations. The ground segment facilities would be operational by 2002. Individual components of the ground segment are discussed below.

The space segment would include three, and potentially four, satellite constellations first available for deployment in 2002 with the exception of the existing DSP satellite constellation. The first constellation is the existing DSP constellation, the second is a GEO constellation consisting of four satellites, and the third is a HEO constellation consisting of two satellites. The fourth potential constellation would be comprised of LEO satellites. Individual components of the space segment are discussed below.

The proposed action for this phase of the acquisition is the initiation of the DSP consolidation process, development and testing of the GEO satellites, design and testing of the antennas for the overall SBIRS program, and Atlas IIAS or EELV operations at Cape Canaveral AS, Florida. Related future SBIRS actions will be decided based upon site specific environmental assessments for those actions.

Figure 1 Space Based Infrared System Program

2.1.1 Mission Control Station

Two large antennas would be required at Buckley ANGB in addition to utilization of the Mission Control Station (MCS) to support the operational SBIRS. The MCS was an independent action with its own EA and FONSI (USAF, 1996a).. These antennas were not included in the MCS EA since they were not needed for the DSP consolidation. These antennas would be located on the west side of the existing developed area of Buckley ANGB, inside the security fence for the Aerospace Data Facility (ADF) and 2nd Space Warning Squadron (2 SWS) complex. The area within the security fence is a special-use zone containing approximately 120 acres that is currently used by the ADF and the 2 SWS, which are tenants at Buckley ANGB. The specific size, operating parameters, and location within the ADF/2 SWS complex of these antennas have not yet been determined. These antennas would likely be installed in radomes on concrete pads with electrical and communication cable connections to existing facilities, including uninterruptible and emergency power systems. For each antenna, a total of 0.5 acres of land would be disturbed and converted to impervious cover. No additional personnel would be required.

The MCS antennas will be addressed in a subsequent tiered EIAP document prior to a commitment to construction.

2.1.2 Mission Control Station Backup

The MCS backup (MCS-B) would be a redundant MCS with full MCS capabilities. This facility would be maintained by minimal personnel under normal conditions and manned by operational personnel under emergency conditions. A specific location and facility characteristics have not been determined.

Two antennas similar to those that would be used for the MCS would be installed in radomes outside the facility. As with the MCS antennas, the specific size, operating parameters, and location have not yet been determined. An estimated ten contractor and five government permanent personnel would be required to maintain the readiness capability of the facility. Data processing and office equipment would be installed in the building. The MCS-B would either be situated in an existing facility or a new facility would be constructed. Approximately 20,000 square feet (ft^2) of space would be required. Utilities would be provided through government installation or commercial sources, and an uninterruptible power supply (UPS) system with backup power generation capability would be needed.

The MCS-B and MCS-B antennas will be addressed in a subsequent tiered EIAP document prior to a commitment to construction. No significant impacts are anticipated.

2.1.3 Survivable Mission Control Station Backup

The survivable MCS-B would be a limited function MCS with the capability to survive the electromagnetic pulse from a nearby nuclear detonation. It would only be used under emergency conditions.

The survivable MCS-B would be a metal structure with an area of approximately 1,000 ft^2 in an existing government installation on a concrete pad with utility connections to existing facilities, including water, sewer, and uninterruptible and emergency power systems. A new antenna in a radome would be installed near this facility on a concrete pad. A total of 0.5 acres of land would be disturbed by the facility and antenna and converted to impervious cover. No permanent personnel would be required during normal conditions, and maintenance would be performed by existing personnel at the installation. The building would contain data processing and office equipment.

The survivable MCS-B and survivable MCS-B antennas will be addressed in a subsequent tiered EIAP document prior to a commitment to construction. No significant impacts are anticipated.

2.1.4 Relocatable Terminals

The multiple relocatable terminals (RT) would be limited function backup MCSs. Each RT would comprise a tractor/trailer combination with radio communication capabilities that would be deployed under emergency conditions. Under normal conditions, the RTs would be garrisoned at Peterson Air Force Base (AFB), Colorado, and Offutt AFB, Nebraska. Under emergency conditions, the RTs would deploy with the United States (U.S.) Space Command Mobile Consolidated Control Center (MCCC) Commander-in-Chief Mobile Alternate Headquarters (CMAH) and the U.S. Strategic Command CMAH. The RTs will be addressed in a subsequent tiered EIAP document prior to a commitment to production. No significant impacts are anticipated.

2.1.5 Relay Ground Stations

SBIRS would include two overseas relay ground stations (RGS) to relay infrared (IR) event data, satellite state of health data, and command data between the DSP satellites, geosynchronous Earth orbit (GEO) satellites, and potential low Earth orbit (LEO) satellites and the MCS and MCS-B. The characteristics of the RGS facilities would be essentially the same as the survivable MCS-B described earlier. The two RGS facilities will be addressed in a subsequent tiered EIAP document prior to a commitment to construction. No significant impacts are anticipated.

2.1.6 Satellite Constellations

Three, and potentially four, satellite constellations would be included in the SBIRS program.

2.1.6.1 Defense Support Program

The DSP satellites would continue in use through the end of their operational life early in the next century, but would be integrated with the SBIRS program, sending and receiving data and commands through the SBIRS ground segment. The consolidation of DSP ground processing functions at the MCS has been previously assessed in an EA with a signed FONSI (USAF, 1996a), the latest acquisition of DSP satellites has been assessed in an EA with a signed FONSI (USAF, 1993a), and the Titan IV launch vehicle for these satellites has been assessed in an EA with a signed FONSI (USAF, 1990). These EAs are hereby incorporated by reference. Further analysis is not considered necessary.

2.1.6.2 Geosynchronous Earth Orbit Satellites

The GEO satellite constellation would include four operational satellites available for launch by 2002. These satellites would be launched from Cape Canaveral Air Station (AS), Florida as shown in Figure 2. This overview EA will analyze the impacts associated with eight launches with up to four launches in a given year.

The GEO satellite is in a notional design stage at this point in the acquisition process. The characteristics provided in this section are based on other typical DoD satellites such as the Defense Satellite Communications System (DSCS), DSP, or NAVSTAR Global Positioning System (GPS). The wet weight of the satellite would be approximately 6,000 to 9,000 pounds and the satellite would probably be fueled by hydrazine or a hydrazine compound with nitrogen tetroxide as oxidizer. Monopropellant hydrazine with no oxidizer could also be a possibility. Approximately 1,500 to 3,000 pounds each of fuel and oxidizer would be carried.

Helium would probably be utilized as the pressurant for satellite systems. The fuel, oxidizer, and helium would likely be carried in titanium tanks or metal tanks with a composite overwrap. Batteries would probably be nickel hydrogen. There would be no ionizing radiation sources, but the satellite would include antennas which would be nonionizing radiation sources.

Figure 2 General Location Map Cape Canaveral Air Station

Prelaunch Satellite Processing

The locations for satellite processing at Cape Canaveral AS have not been determined at this time. Aside from operational launch complexes, facilities with the requisite air emission permits include the Defense Satellite Communications System (DSCS) Processing Facility (DPF) (Facility 55820), the Payload Spin Test Facility (PSTF) (Facility 67900), the Propellant Servicing Facility (PSF) (Facility 55840), and the Spacecraft Processing and Integration Facility (SPIF) (Facility 70000). The location of these facilities is shown on Figure 3. Up to fifty contractor personnel could be required during prelaunch processing operations for a period of up to 60 days.

2.1.6.3 Highly Elliptical Orbit

As indicated in Section 1.4 under the scope of this document, the HEO constellation will not be comprised of satellites per se, but will be extra payloads carried on other satellites. The HEO payloads would be available for launch by 2002. The program entity responsible for deployment of these satellites will be responsible for NEPA analysis for the satellites and the attached HEO payload, launch vehicle, and prelaunch processing operations.

2.1.7 Launch Vehicle

The baseline launch vehicle (LV) for the GEO satellite constellation is the Atlas IIAS, which is a medium launch vehicle. The Atlas IIAS is the current launch vehicle best suited to carrying this size payload but it may be replaced by the EELV. If the EELV is chosen to substitute for the current launch system, that decision is independent of this action and will be assessed separately in another EIAP. First delivery of GEO satellites is anticipated in fiscal year 2002 (FY02) for a launch some time after delivery.

Figure 3 Potential Satellite Processing Locations

The Atlas IIAS uses a core vehicle consisting of a booster section and a sustainer section, which together comprise 1-1/2 stages using propellants from the same tanks. The core vehicle uses 108,000 pounds of Rocket Propellant 1 (RP-1) as fuel and 242,000 pounds of liquid oxygen as oxidizer. RP-1 is a kerosene hydrocarbon. Hydrazine-fueled thrusters provide roll control. Four solid rocket motors (SRM) contain 22,300 pounds of hydroxyl terminated polybutadiene (HTPB) each as propellant with the casing constructed of steel. HTPB propellant contains aluminum as fuel and ammonium perchlorate as oxidizer with HTPB as a bonding material. The Atlas IIAS uses a Centaur II upper stage which is fueled by 5,692 pounds of liquid hydrogen and uses 31,308 pounds of liquid oxygen as oxidizer. Additionally, approximately 210 pounds of hydrazine fuels small catalytic thrusters that provide reaction and roll control for the core vehicle and the Centaur II. Figure 4 shows an Atlas IIAS.

At Cape Canaveral AS, commercial launches of the Atlas IIAS at a rate of up to four per year were assessed in an EA with a signed FONSI dated August 1991 (USAF, 1991). Defense launches "in the event of national emergency" were also included. This EA is hereby incorporated by reference. Impacts specific to the Atlas IIAS such as the use of certain prelaunch processing facilities and Space Launch Complex 36B (SLC-36B) are not included.

Additional supporting environmental analysis is found in an EA with a signed FONSI dated February 1989 for the Medium Launch Vehicle II program (USAF, 1989a). This EA evaluated the environmental impacts associated with eleven launches of the Atlas II LV, and is hereby incorporated by reference. The Atlas II core vehicle is identical to the Atlas IIAS. The Atlas II uses a different model of the Centaur upper stage and has no SRMs.

2.2 NO ACTION ALTERNATIVE

The no action alternative would be continued reliance on the DSP system with consolidated ground processing functions until the satellites reach the end of their operational life.

2.3 ALTERNATIVES ELIMINATED FROM FURTHER CONSIDERATION

At this point in the procurement process, no alternatives have been eliminated from consideration except the use of facilities at Vandenberg AFB, California, for launch of the GEO satellites. Vandenberg AFB and Cape Canaveral AS are the two facilities used for launch of DoD satellites. The orbital requirements of the GEO satellites cannot be supported by launches from Vandenberg AFB.

Figure 4 Diagram of the Atlas IIAS

2.4 PERMITS OR CONSULTATION REQUIRED

The proposed and alternative actions are largely notional at this point in the acquisition process. Until more specific proposals have been advanced, the necessary permits cannot be identified. Full compliance with Section 106 of the National Historic Preservation Act and Section 7 of the Endangered Species Act may require consultation with appropriate state and federal agencies.

2.5 SUMMARY OF ENVIRONMENTAL IMPACTS

Tables 1 through 2 summarizes the impacts of the proposed action and alternative actions, including the no action alternative, for the components of the SBIRS program that were analyzed in Section 4. No significant impacts are expected from either the proposed or alternative action for any of the resources analyzed.

Table 1 Geosynchronous Earth Orbit Satellites Summary of Impacts

Resource	Proposed Action Cape Canaveral AS	No Action
Air Quality	Estimated emissions less than one ton for individual criteria pollutants, 0.0083 percent of Brevard County emissions inventory.	No change from existing conditions.
Water Resources	Compliance with 45 SW OPlans 19-1 and 32-3 will prevent impacts to water resources.	No change from existing conditions.
Solid Waste	For four launches in a year, 20 tons of solid waste or 1.01 percent of current Cape Canaveral AS waste generation.	No change from existing conditions.
Hazardous Materials	The process of handling hazardous materials would not change.	No change from existing conditions.
Hazardous Waste	For four launches in a year, 11,977 pounds of hazardous waste or 1.77 percent of current Cape Canaveral AS off-site transfers.	No change from existing conditions.
Pollution Prevention	Will comply with PPMAP for Cape Canaveral AS.	No change from existing conditions.
Nonionizing Radiation	Radio frequency radiation will either be non-hazardous or controlled so that no personnel are exposed to hazardous levels.	No change from existing conditions.
Cultural Resources	Full compliance with Section 106 of the National Historic Preservation Act will occur.	No change from existing conditions.
Biological Resources	Light management plans will be complied with to protect endangered sea turtles.	No change from existing conditions.
Health and Safety	45 MG/SGPB and 45 MG/SGPS will review and approve all health and nonionizing radiation procedures.	No change from existing conditions.
Geosynchronous Earth Orbit	The GEO satellites would occupy approximately 2.2 percent of the available GEO orbital slots.	No change from existing conditions.

Table 2 Launch Vehicle Summary of Impacts

Resource	Proposed Action Cape Canaveral AS	No Action
Air Quality	Total emissions are not expected to cause a violation of the national or Florida ambient air quality standards. Prelaunch processing quantities are less than those considered de minimis by EPA under its Clean Air Act conformity regulations. A conformity analysis is not required since the Cape Canaveral AS area is in attainment. Concentrations of hazardous constituents in the ground cloud from launch or catastrophic failure would not be hazardous to personnel in exposed areas.	No change from existing conditions.
Noise	Clear zones will ensure that personnel are not exposed to hazardous noise levels. Noise levels outside the installation boundaries from launches could be annoying, but would occur for short durations. Wildlife, including threatened and endangered species, may suffer temporary hearing loss in the immediate area of the launch complex.	No change from existing conditions.
Hazardous Materials	The process of handling hazardous materials would not change.	No change from existing conditions.
Hazardous Waste	LV program would generate an estimated 8 tons of hazardous waste annually or 2.4 percent of current Cape Canaveral AS off- site transfers. Overall launch rate at base will not change from current baseline, so no increase anticipated.	No change from existing conditions.
Solid Waste	Estimated 2.5 tons of solid waste or 0.13 percent of current Cape Canaveral AS waste generation. Overall launch rate at base will not change from curre nt baseline, so no increase anticipated.	No change from existing conditions.
Pollution Prevention	Will comply with PPMAP for Cape Canaveral AS.	No change from existing conditions.

Biological Resources	Effects from normal launches would be limited to the launch complex which is a disturbed area with poor habitat. Under certain circumstances, minor foliar damage to vegetation could occur from hydrochloric acid. Adverse effects from catastrophic launch failures would be localized. The anticipated concentr ations of constituents in the launch cloud for anticipated times of exposure would not adversely affect biological communities, including threatened and endangered species, except within the launch complex. Lighting policy will be complied with to protect endangered sea turtles.	No change from existing conditions.
Nonionizing Radiation	Radio frequency radiation will either be non- hazardous or controlled so that no personnel are exposed to hazardous levels.	No change from existing conditions.

Table 2 Summary of Impacts, continued

Resource	Proposed Action Cape Canaveral AS	No Action
Water Resources	Compliance with 45 SW OPlans 19 - 1 and 32 - 3 will prevent impacts to water resources. Anticipated concentrations of constituents in the launch cloud would not adversely affect water quality.	No change from existing conditions.
Cultural Resources	Full compliance with Section 106 of the National Historic Preservation Act will occur in association with EIAP for EELV.	No change from existing conditions.
Water Supply	Cape Canaveral AS system designed to provide deluge water for launches. For each launch, an amount approximately equal to one day's average usage for Cape Canaveral AS will be required.	No change from existing conditions.
Health and Safety	45 MG/SGPB and 45 MG/SGPS will review and approve all health and nonionizing radiation procedures. Risk to exposed individuals from reentering launch vehicle is substantially less than everyday hazards such as work accidents or lightning.	No change from existing conditions.
Stratospheric Ozone	Quantifiable human health effects due to ozone depletion are less than one extra cancer case per million persons. Effects on the natural environment are not quantifiable, but not anticipated to be significant.	No change from existing conditions.

SECTION 3

AFFECTED ENVIRONMENT

This section describes the baseline environmental resources that are relevant to the decision to be made. The level of detail of the baseline data presented in the following sections reflects the likelihood and significance of potential impacts.

This section includes baseline information for Cape Canaveral AS, Florida, since prelaunch processing of the satellites and launches will occur at that location. The affected environment for the various ground facilities is not included since these activities are similar to other actions that have been determined to have insignificant impacts or would be located on other bases or locations with similar facilities that have been determined to have insignificant impacts. The specific sites for the ground facilities are still to be determined.

This section is organized by resource areas at Cape Canaveral AS, Florida, that will be considered under individual program components in Section 4.Baseline environmental conditions for a global resource area, stratospheric ozone, that is applicable to the satellites and the launch vehicle are presented.

3.1 GEOSYNCHRONOUS EARTH ORBIT SATELLITES

3.1.1 Installation Background

Cape Canaveral AS is located on Cape Canaveral in Brevard County, on Florida's Atlantic coastline near the City of Cocoa Beach as previously shown in Figure 2. Cape Canaveral AS is located on the northern portion of a barrier island. The island is bounded by the Atlantic Ocean to the east and the Banana River to the west.

In 1947, Cape Canaveral AS was selected as the location for a U.S. missile testing range, with construction beginning in 1950. The first missile was launched from Cape Canaveral AS on July 24, 1950. Continuous advancement in technology made possible the launching of the National Aeronautics and Space Administration (NASA) Saturn 1B in 1961, the Air Force Titan II in 1974, and the Navy Trident missile, which began testing in 1977. Cape Canaveral AS has 81 miles of paved roads which connect various launch and support facilities with the centralized industrial area. Development of Cape

Canaveral AS as a missile test center has produced an installation that is unique with respect to other Air Force installations (USAF, 1994b).

Cape Canaveral AS occupies a total of 15,804 acres of land (USAF, 1994b). Facilities at Cape Canaveral AS are scattered, with scrub vegetation separating these developed areas. Elevations range from sea level to 15 to 20 feet above mean sea level.

3.1.2 Air Quality

Air quality in any given region is measured by the concentration of various pollutants in the atmosphere, typically expressed in units of parts per million (ppm) or in units of micrograms per cubic meter ($\mu g/m^3$). Air quality is not only determined by the types and quantities of atmospheric pollutants, but also by surface topography, the size of the air basin, and by the prevailing meteorological conditions.

The Clean Air Act Amendments of 1990 (CAAA) directed the U.S. Environmental Protection Agency (USEPA) to develop, implement, and enforce environmental regulations that would ensure cleaner air for all Americans. The USEPA established both primary and secondary national ambient air quality standards (NAAQS) under the provisions of the CAAA. Primary standards define levels of air quality necessary to protect public health with an adequate margin of safety. Secondary standards define levels of air quality necessary to protect public welfare (i.e., soils, vegetation, and wildlife) from any known or anticipated adverse effects from a criteria air pollutant. The CAAA also set emission limits for certain air pollutants for new or modified major sources based on best demonstrated technologies, and established health-based national emissions standards for hazardous air pollutants.

NAAQS are currently established for six air pollutants (known as "criteria air pollutants") including carbon monoxide (CO), nitrogen oxides (NO_X, measured as nitrogen dioxide, NO_2), ozone (O_3), sulfur oxides (SO_X, measured as sulfur dioxide, SO_2), lead (Pb), and particulate matter equal to or less than 10 microns in aerodynamic diameter (PM_{10}). There are many suspended particles in the atmosphere with aerodynamic diameters larger than 10 microns, and the collective of all particle sizes is commonly referred to as total suspended particulates (TSP).

Although O_3 is considered a criteria air pollutant and is measurable in the atmosphere, it is not often considered as an air pollutant when calculating emissions because O_3 is typically not emitted directly from most emissions sources. O_3 is formed in the atmosphere from its precursors, NO_X and volatile organic compounds (VOC), which are directly emitted from various emission sources. For this reason, NO_X and VOCs are commonly reported in an air emissions inventory instead of O_3.

The USEPA classifies the air quality within an air quality control region (AQCR) according to whether or not the concentration of criteria air pollutants in the atmosphere

exceed primary or secondary NAAQS. All areas within each AQCR are assigned a designation of either attainment or nonattainment for each criteria air pollutant. An attainment designation indicates that the air quality within specific areas of an AQCR is either "unclassified" or that the air quality is as good as or better than NAAQS for individual criteria air pollutants. Unclassified indicates that the air quality within an area cannot be classified and is therefore treated as attainment. Nonattainment indicates that concentration of an individual criteria air pollutant at a specific location exceeds primary or secondary NAAQS. Before a nonattainment area is eligible for reclassification to attainment status, the state must demonstrate compliance with NAAQS in the nonattainment area for three consecutive years and demonstrate through extensive dispersion modeling that attainment status can be maintained in the future even with community growth.

The CAAA does not make the NAAQS directly enforceable, but requires each state to promulgate regulatory requirements necessary to implement the NAAQS. The CAAA also allows states to adopt air quality standards that are more stringent than the federal standards.

The state of Florida has adopted the NAAQS except for SO_2. The state requires the NAAQS be met at ambient air, defined as air that is accessible to the general public. National and state primary and secondary air quality standards are presented in Table 3.

The air quality at Cape Canaveral AS is considered good since there are few air pollution sources in the local area and there is a predominant sea breeze. Cape Canaveral AS is located in the federally defined Central Florida Intrastate Air Quality Control Region (AQCR 48). The AQCR consists of the following counties: Brevard, Lake, Orange, Osceola, Seminole, and Volusia. AQCR 48 is classified by USEPA as an attainment area for all of the criteria pollutants. Attainment means that the air quality in an area is equal to or better than the NAAQS.

Baseline emissions of criteria pollutants for Brevard County for 1993 are summarized in Table 4. This emissions inventory represents the most currently available data for Brevard County (FDEP, 1996). The Brevard County emissions inventory accounts for permitted stationary and point sources that are required to report annual emissions to the Florida Department of Environmental Protection (FDEP). This inventory includes all permitted air emissions source at Cape Canaveral AS, including permitted power generators, boilers, paint booths, and propellant loading operations, among others. A recent emissions inventory for Cape Canaveral AS is not available. An effort is currently underway to develop a complete inventory of all air emissions sources (both permitted and non-permitted) at Cape Canaveral AS, with anticipated completion in the summer of 1996 (Camaradese, 1996).

The climate of Cape Canaveral AS is characterized by long, relatively humid summers and mild winters. Owing to its location adjacent to the Atlantic Ocean and the Indian and Banana Rivers, annual variations in temperature are moderate. The annual average temperature at Cape Canaveral AS is 71 degrees Fahrenheit (°F) (USAF, 1989b).

Table 3 National and Florida Ambient Air Quality Standards

Criteria Pollutant	Averaging Time	Primary NAAQS[a,b,c]	Secondary NAAQS[a,b,d]	Florida Standards[a,b]
Carbon Monoxide	8-hour 1-hour	9 ppm (10,000 μg/m ^{3}) 35 ppm (40,000 μg/m ^{3})		9 ppm (10,000 μg/m ^{3}) 35 ppm (40,000 μg/m ^{3})
Lead	Quarterly	1.5 μg/m ^{3}	1.5 μg/m ^{3}	1.5 μg/m ^{3}
Nitrogen Oxides (measured as NO_2)	Annual	0.0543 ppm (100 μg/m ^{3})	0.0543 ppm (100 μg/m ^{3})	0.0543 ppm (100 μg/m ^{3})
Ozone	1-hour	0.12 ppm (235 μg/m ^{3})	0.12 ppm (235 μg/m ^{3})	0.12 ppm (235 μg/m ^{3})
Particulate Matter (measured as TSP)	Annual 24-hour	50 μg/m ^{3} 150 μg/m ^{3}	50 μg/m ^{3} 150 μg/m ^{3}	50 μg/m ^{3} 150 μg/m ^{3}
Sulfur Oxides (measured as SO_2)	Annual 24-hour 3-hour	0.03 ppm (80 μg/m ^{3}) 0.14 ppm (365 μg/m ^{3})	0.50 ppm (1,300 μg/m ^{3})	0.02 ppm (60 μg/m ^{3}) 0.10 ppm (260 μg/m ^{3}) 0.50 ppm (1,300 μg/m ^{3})

[a] National and state standards, other than those based on an annual or quarterly arithmetic mean, are not to be exceeded more than once per year. The ozone standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above the standard is less than or equal to one.

[b] The NAAQS and Florida standards are based on standard temperature and pressure of 25 degrees Celsius and 760 millimeters of mercury.

[c] National Primary Standards: The levels of air quality necessary to protect the public health with an adequate margin of safety. Each state must attain the primary standards no later than three years after the state implementation plan is approved by the USEPA.

[d] National Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant. Each state must attain the secondary standards within a “reasonable time” after the state implementation plan is approved by the USEPA.

Table 4 Baseline Criteria Pollutant Emissions for Brevard County, Florida

Pollutant	Tons per Year
Nitrogen oxides	9,498

Sulfur oxides	32,943
Carbon monoxide	960
Particulate matter	2,366
Volatile organics	581
Lead	Not reported

Source: FDEP, 1995

Rainfall distribution is seasonal, with a wet season occurring from May to October, while the remainder of the year is relatively dry. Average annual rainfall for Cape Canaveral AS is 48.5 inches, 70 percent of which occurs from May through October at the rate of approximately 5 inches per month (USAF, 1989b). The Cape Canaveral area has the highest number of thunderstorms in the United States, and one of the highest frequencies of occurrence in the world during the summer. On average, thunderstorms occur 76 days per year at Cape Canaveral. Between May and September, thunderstorms can be expected more than 10 days per month (USAF, 1989b). During the summer months, lightning detection systems indicate that 1,400 ± 840 cloud strikes occur per month on the 135-square mile Kennedy Space Center (NASA, 1990).

3.1.3 Water Resources

Cape Canaveral AS is located on the Canaveral Peninsula, which is a barrier island between the Atlantic Ocean and the Banana River. The majority of ground surface at Cape Canaveral AS is composed of former sand dunes. The surface soils generally consist of highly permeable sand and shell (USAF, 1994a). Surface drainage generally flows west into the Banana River, even near the eastern side of the peninsula.

Two aquifer systems underlay Cape Canaveral AS, the surface aquifer and the Floridan aquifer. The surface aquifer system, which is composed generally of sand and marl, is under unconfined conditions and is approximately 70 feet thick. The water table in the surface aquifer is generally located a few feet below the ground surface. Recharge to the surface aquifer is principally by precipitation. Groundwater in the surface aquifer at Cape Canaveral AS generally flows to the west except along the extreme east coast of the peninsula (USGS, 1962).

A confining unit composed of clays, sands, and limestone separates the surface aquifer from the underlying Floridan aquifer. The confining unit is generally 80 to 120 feet thick. The relatively low hydraulic conductivity of the confining unit restricts the vertical exchange of water between the surface aquifer and the underlying confined Floridan aquifer. Groundwater in the Floridan aquifer at Cape Canaveral AS is highly mineralized, and therefore is not used as a source of drinking water.

Cape Canaveral AS is located in the Florida Middle East Coast Basin (United States Geological Survey Hydrologic Unit 030802020). The Middle East Coast Basin contains three major bodies of water in proximity to Cape Canaveral AS: the Banana River to the immediate west, Mosquito Lagoon to the north, and the Indian River to the west, separated from the Banana River by Merritt Island. All three water bodies are estuarine lagoons with circulation provided mainly by wind-induced currents.

Studies indicate that ambient conditions in the Banana River, Indian River, and Mosquito Lagoon are typical of estuarine waters, with the exception of some areas affected by point source loading (FDEP, 1992; BC, 1991). Levels of aluminum, silver, and iron have been reported in excess of state criteria, but seem to be indicative of background concentrations due to their widespread distribution as well as the high level of organic particulate matter found in the area (BC, 1991).

The FDEP has classified water quality in the Middle East Coast Basin as “poor to good” based on the physical and chemical characteristics of the waters as well as whether they meet their designated use under Florida Administrative Code (FAC) 17-3. The upper reaches of the Banana River adjacent to Cape Canaveral AS and the lower reaches of Mosquito Lagoon have generally good water quality due to lack of urban and industrial development in the areas. Lower reaches of the Banana River and Indian River, upper reaches of Mosquito Lagoon, and eastern portions of the Indian River along Merritt Island are classified as fair. Areas of poor water quality exist along the western portions of the Indian River near the City of Titusville and in Newfound Harbor near Sykes Creek in southern Merritt Island. Fair and poor areas are influenced primarily by wastewater treatment plant effluent discharges and urban runoff (FDEP, 1992). Beginning in 1995, discharge of wastewater effluent to the Banana and Indian Rivers will no longer be permitted. Cape Canaveral AS has constructed a new wastewater treatment plant for compliance with this requirement.

Several water bodies in the Middle East Coast Basin have been designated Outstanding Florida Water (OFW) in FAC 17-3, including most of Mosquito Lagoon and the Banana River, Indian River Aquatic Preserve, Banana River State Aquatic Preserve, Pelican Island National Wildlife Refuge, and Canaveral National Seashore (FDEP, 1992). The OFW designation affords water bodies the highest level of protection, and any compromise of ambient water quality is prohibited. Additionally, the Indian River Lagoon System has been designated an Estuary of National Significance by the Environmental Protection Agency. Because of these designations as well as other Florida regulations designed to minimize wastewater discharges and urban runoff in the area, water quality in the Middle East Coast Basin is expected to improve.

In April 1994, the Cape Canaveral AS storm water pollution prevention plan was finalized. The National Pollutant Discharge Elimination System group storm water

permit has not been issued by the EPA as of the date of this assessment. Storm water discharges are also regulated by the Saint Johns River Water Management District. Cape Canaveral will continue to obtain storm water permits for individual facilities or construction projects as necessary from the EPA and Saint Johns River Water Management District.

3.1.4 Solid Waste

Solid waste is managed according to the nature and quantity of the waste. The Cape Canaveral AS landfill located near the airstrip is permitted to accept construction debris, demolition debris, and asbestos-containing material. Waste is segregated within the landfill according to waste type (i.e. concrete waste is placed in one section, wood waste in another, etc.). Cape Canaveral AS disposed of an estimated 9,701 tons of construction and demolition debris in the station landfill over a three-month period during fiscal year 1996, or an average of 3,234 tons per month (Neville, 1996). Based on this average, approximately 38,808 tons would be disposed over the course of a year.

General solid refuse from daily activities at Cape Canaveral AS is collected by private contractor and disposed off-station at the Brevard County Landfill. The Brevard County Landfill is a Class I landfill that occupies 192 acres near the City of Cocoa. The landfill receives between 2,200 and 2,400 tons of solid waste per day (Hunter, 1996). Cape Canaveral AS disposed of approximately 1,986 tons of solid waste in the Brevard County Landfill and recycled 802 tons of solid waste in 1995 (Neville, 1996).

3.1.5 Hazardous Materials

Hazardous materials management is the responsibility of each individual or organization at Cape Canaveral AS. The primary outlet for hazardous materials purchase and acquisition is through Patrick AFB supply channels. Individual hazardous materials obtained through base supply at Patrick AFB are assigned a code which allows limited tracking of the materials and provides knowledge of hazardous materials usage for industrial hygiene and environmental compliance purposes. Patrick AFB has developed a pharmacy-style hazardous materials acquisition system in order to improve hazardous materials tracking, reduce amounts of certain hazardous materials used, and reduce the amount of waste generated as result of expired shelf-life materials. Under this system, only specific individuals within an organization can order and sign for hazardous materials. The hazardous materials pharmacy will not store or issue propellants.

The hazardous materials pharmacy operated by Patrick AFB is not currently established or enforced at Cape Canaveral AS. As such, individual contractors at Cape Canaveral AS may also obtain hazardous materials through their own supply organizations, local purchases, or other outside channels. Under the new hazardous materials pharmacy approach, contractors are encouraged to obtain hazardous materials

through the pharmacy whenever possible. Contractors that must obtain hazardous materials through other channels (e.g., products not readily available through standard government supply organizations) will be required to register the materials with the pharmacy's central tracking location prior to bringing the product on the facility. Large quantities of materials obtained outside of the pharmacy system will be required to be stored with pharmacy stock and distributed to the contractor as needed in specified quantities.

Hazardous materials must be handled and stored in accordance with Occupational Safety and Health Administration, Environmental Protection Agency, and Air Force regulations. Bulk-quantity storage of hazardous materials is limited to designated storage areas at Cape Canaveral AS. Smaller, shelf-life items, such as paints and varnishes, are stored in approved petroleum, oil, and lubricant storage cabinets maintained by individual contractors. Hazardous fuels are controlled by the Joint Propellants Contractor (JPC) for 45th Space Wing (45 SW). The JPC provides for the purchase, transport, temporary storage, and loading of hazardous fuels and oxidizers.

Spills of hazardous materials are covered under 45 SW OPlan 19-1, Oil and Hazardous Substances Pollution Contingency Plan, required by 40 CFR 112, and 45 SW OPlan 32-3, Disaster Preparedness Plan. Included in OPlans 19-1 and 32-3 are all applicable federal, state, and local contacts in the event of a spill.

The Superfund Amendments and Reauthorization Act (SARA) of 1986 incorporated reporting requirements in Title III. Pursuant to Executive Order 12856, signed August 4, 1993, federal facilities are now subject to these reporting requirements.

Under Section 311 of SARA Title III, facilities which must prepare or have available Material Safety Data Sheets (MSDS) under Occupational Safety and Health Administration regulations are required to submit the MSDSs or a list of MSDSs for materials stored in excess of reporting thresholds to the local emergency planning committee, the state emergency response commission, and the local fire department. Under Section 312, the same facilities must also submit an emergency and hazardous material inventory form (Tier I or Tier II) for each material reported under Section 311. Under Section 313, facilities using over 10,000 pounds of listed toxic chemicals in a calendar year must submit an annual toxic release inventory Form R for each chemical to the Environmental Protection Agency and designated state officials. According to Form R reporting requirements, chemicals and fuels used to directly support mobile source operations, including operations involving missiles, rockets, other launch vehicles, and space vehicles, are not required to be included in determination of amounts reported under Section 313. As such, chemicals used in processing and launch operations which directly support these types of vehicles are exempt from Section 313 reporting requirements. Cape Canaveral AS was required to submit Section 311 information by August 1995 and

Section 312 information by March 1, 1996, for the calendar year (CY) 1995 reporting period. Cape Canaveral AS is required to submit any applicable Section 313 Forms R by July 1, 1996 for the CY95 reporting period.

Contractors and programs operating at Cape Canaveral AS must provide 45 CES/CEV and 45 MDG/SGPB with copies of MSDSs for all hazardous materials proposed for use. Additionally, information on hazardous materials used by contractors or programs must be provided to 45 CES/CEV in accordance with SARA Title III and Clean Air Act Title V reporting requirements.

3.1.6 Hazardous Waste

Hazardous substances are defined under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act and the Toxic Substances Control Act. Hazardous wastes are defined under the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act (RCRA), which was amended by the Hazardous and Solid Waste Amendments (HSWA). In general, both hazardous substances and wastes include substances that, because of their quantity, concentration, physical, chemical, or infectious characteristics, may present substantial danger to public health or welfare or to the environment when released into the environment or otherwise improperly managed. Executive Order (EO) 12088 requires that necessary actions be taken for the prevention, management, and abatement of environmental pollution from activities at federal facilities utilizing hazardous materials or resulting in the generation of hazardous waste.

Hazardous waste management at Cape Canaveral AS is regulated under 40 CFR, Parts 260 through 280, and Florida Administrative Code (FAC) 62-730. These regulations are implemented at Cape Canaveral AS through 45 SW OPlan 19-14, Petroleum Products and Hazardous Waste Management Plan. Five main entities are involved in hazardous waste management and disposal for Cape Canaveral AS. These include the generator of the waste, the JPC, the Launch Base Support Contractor (LBSC) for Cape Canaveral AS, the Defense Reutilization and Marketing Office (DRMO) of the Department of Defense, and the environmental support organization at Patrick AFB (45 CES/CEV).

The U.S. Air Force, as the owner of the facilities at Cape Canaveral AS, is considered the generator of DoD-generated hazardous wastes at Cape Canaveral AS. All hazardous waste generated by DoD operations at Cape Canaveral AS is labeled with the U.S. Air Force's USEPA identification number for Cape Canaveral AS, and it is transported, treated, and disposed under this number. Commercial space operations as well as all construction contractors are required to dispose of their hazardous waste under a USEPA identification number other than the Air Force Cape Canaveral AS number. Each individual or organization at Cape Canaveral AS is responsible to the Air Force for

identifying, minimizing, packaging, and labeling hazardous waste generated by their activities, as well as requesting sampling and pickup of hazardous waste by the JPC. Additionally, they are responsible for administering all applicable regulations and plans regarding hazardous waste, and for complying with applicable regulations regarding the temporary accumulation of hazardous waste at the process site. Physical generators of hazardous waste are required to submit to the JPC each year a process waste questionnaire technical response package which details the types and amounts of hazardous wastes expected to be generated during the year. The JPC assigns each hazardous waste stream a process waste code so that the waste may be tracked from generation through disposal.

The JPC services include waste determinations sampling, pickup, packaging assistance, technical assistance, and disposal of petroleum products, hazardous wastes, and non-hazardous wastes. The JPC collects and transports hazardous waste from the process site to a 90-day hazardous waste accumulation area, one of three permitted one-year hazardous waste storage facilities at Cape Canaveral AS, or to a licensed disposal facility off-station. They are responsible to the Air Force for providing an operational level of hazardous waste disposal which complies with all applicable regulations governing handling, transport, storage, treatment, and disposal or reclamation of the waste.

The LBSC provides environmental management and technical support for Cape Canaveral AS. The LBSC ensures that contractors have hazardous waste management programs in place, offers hazardous waste training, and reviews and inspects contractors to ascertain compliance with OPlan 19-14 and all applicable federal, state, and local regulations. Additionally, the LBSC operates the permitted hazardous waste storage areas on Cape Canaveral AS, maintains records and inventories of permitted hazardous waste storage and process site accumulation areas, and maintains records pertaining to facility inspections, hazardous waste training, safety training, and other hazardous waste matters.

The DRMO is responsible for managing and marketing excess and recoverable products and waste materials in accordance with applicable regulations. Hazardous items which cannot be marketed by the DRMO are disposed of as hazardous wastes. The DRMO is also responsible for obtaining offsite hazardous and non-hazardous wastes disposal contracts at all downrange sites.

The 45 CES/CEV at Patrick AFB is the environmental support organization which provides oversight of the LBSC at Cape Canaveral AS. 45 CES/CEV acts as the point of contact with regulatory agencies and informs the LBSC and JPC of new policies and policy changes concerning hazardous waste management.

Cape Canaveral AS currently operates a single main hazardous waste storage facility (Facility Number 44205) which is permitted (RCRA Permit Number HO01-255040) to store hazardous wastes for up to one year. This facility was constructed within the last year to replace three facilities previously used to store hazardous waste (Numbers 44632, 54810, and 55123). The three previous hazardous waste storage facilities are currently undergoing closure and are no longer used. The single hazardous waste storage site is not permitted to store hydrazine, monomethyl hydrazine, or nitrogen tetroxide hazardous wastes. The wastes must be taken offsite for storage and disposal before temporary accumulation time limits have been reached. In addition, Cape Canaveral AS currently operates one hazardous waste treatment facility (Facility Number 15305), the Explosive Ordnance Disposal Facility, which provides thermal treatment of waste explosive ordnance.

Individual contractors and organizations at Cape Canaveral AS maintain hazardous waste satellite accumulation points and 90-day hazardous waste accumulation areas in accordance with 45 SW OPlan 19-14. Hazardous waste satellite accumulation points are volume-based accumulation sites operated at or near the point of hazardous waste generation. A maximum of 55 gallons per waste stream of hazardous waste (or one quart of acutely hazardous waste) can be accumulated at a satellite accumulation point. Once the volume limit is reached the container of hazardous waste must be dated and moved to a 90-day accumulation area or to a permitted storage facility within 72 hours. Satellite accumulation points have indefinite accumulation times. 90-day hazardous waste accumulation areas are time-based accumulation sites used for temporary accumulation of hazardous waste. Hazardous wastes must be moved from a 90-day accumulation area to a permitted hazardous waste storage, transfer, treatment, or disposal facility within 90 days from the accumulation start date. There is no limit on the volume of hazardous waste that can be accumulated at a 90-day hazardous waste accumulation area.

Contractors shall make arrangements with the LBSC to establish any accumulation areas as necessary, and shall submit a process waste questionnaire technical response package to the JPC detailing the type and amount of any hazardous wastes expected to be generated during operations. The JPC will be responsible for collection and transportation of hazardous wastes from any accumulation sites established.

Cape Canaveral AS reported the off-site transfer of 676,000 pounds of hazardous waste in 1995. Approximately 180,800 pounds of hazardous waste was produced by oxidizer scrubbers (Albury, 1996).

3.1.7 Pollution Prevention

The Air Force has taken a proactive stance in developing a pollution prevention program (PPP) to implement the regulatory mandates in the Pollution Prevention Act of 1990, EO 12856 Federal Compliance with Right-to-Know Laws and Pollution Prevention

Requirements, EO 12873 Federal Acquisition, Recycling, and Waste Prevention, and EO 12902 Energy Efficiency and Water Conservation at Federal Facilities.

AFI 32-7080, dated 12 May 1994, provides the directive requirements for the Air Force PPP. AFI 32-7080 incorporates by reference applicable Federal, DoD, and Air Force level regulations and directives for pollution prevention. As required by the System Acquisition Management Plan (SAMP), the Air Force will undertake the following management activities::

- Appoint a qualified individual as a Pollution Prevention Manager.
- Establish working groups/integrated product teams as necessary to address issues, resolve problems, and verify compliance with laws, regulations, executive orders, and policies with members including representatives from the program office; SMC safety, health, and environmental staff; and the contractor (when appropriate).
- Incorporate pollution prevention requirements into contract documents as an integral part of the management and engineering processes. Pollution prevention will be considered a top priority in mitigating environmental risks during the program's life cycle.
- Require contractors to identify, evaluate, and justify use of hazardous materials needed throughout the design, manufacturing, operation, and disposal of the proposed system.

Each installation is required to incorporate appropriate management, measurement, and reporting goals within the installation pollution prevention management action plan (PPMAP) to comply with all program elements of the Air Force pollution prevention plan (PPP).

Cape Canaveral AS is currently developing a PPMAP to incorporate the elements of the Air Force PPP. The PPMAP is scheduled to be completed by the fourth quarter of fiscal year 1996 (Camaradese, 1996).

3.1.8 Nonionizing Radiation

Nonionizing radiation is electromagnetic radiation emitted at wavelengths whose photon energy is not high enough to ionize or "charge" an absorbing molecule (i.e. human tissue). Nonionizing radiation is considered to be that part of the electromagnetic radiation spectrum with wavelengths greater than 10^{-7} meters and consists primarily of near ultraviolet radiation, visible radiation or light, infrared radiation, and radio frequency (RF) radiation. RF radiation accounts for the largest range of frequencies among the various types of nonionizing radiation and is used extensively to transmit radio,

television, and radar signals. RF radiation has a frequency range of 10 kilohertz to 300 gigahertz.

Nonionizing radiation has intrinsic energies far too small to ionize molecules within a living organism. Rather than evoking changes in molecules (as in ionizing radiation), nonionizing radiation simply agitates molecules making them vibrate and rotate faster than normal, the equivalent of adding heat to the body. When exposure to RF radiation ends, molecular agitation produced by the RF radiation ceases. Heat induced in a warm-blooded animal by exposure to RF radiation at relatively low incident power densities is normally accommodated within the thermoregulatory capabilities of the animal. However, depending on the species, heat produced at relatively high intensities may exceed the thermoregulatory capabilities of the animal, and compensation for such effects may be inadequate. Exposure at high intensities, therefore, could cause gross heating and subsequent thermal distress or irreversible thermal damage.

RF radiation sources exist throughout most Air Force installations. These are typically in the form of transmitting antennas and radar facilities. RF radiation hazards can exist when there is sufficient power contained in the incident radiation from these sources to cause damage to humans. Humans are affected when RF radiation agitates the molecules of the body, causing them to vibrate and rotate faster than normal. This accelerated motion produces heat. When exposure to RF radiation ends, the additional molecular agitation stops.

Standards to limit RF radiation hazards are expressed in the form of permissible exposure levels (PEL) by the Air Force. A PEL is the exposure level in milliwatts per square centimeter (mW/cm^2) to which an individual may be repeatedly exposed, and which, under the conditions of exposure, will not cause detectable bodily injury regardless of age, gender, or child-bearing status. Air Force Occupational Safety and Health Standard 48-9 establishes PELs for RF radiation averaged over a six-minute exposure time based on the frequency of the emitted radiation. PELs are used to determine "safe distances" from RF sources beyond which RF radiation hazards will not occur.

The most current standards for nonionizing radiation exposure are based on maximum permissible exposure (MPE) levels recommended by the Institute of Electrical and Electronics Engineers (IEEE, 1992). The MPE level varies depending on the frequency of the RF source and whether or not emissions occur in controlled or uncontrolled environments. Like PELs, MPEs are expressed in mW/cm^2. The IEEE standard is recognized as an American National Standard by the American National Standards Institute (ANSI).

There are numerous transmitting antennas at Cape Canaveral AS. All activities generating nonionizing radiation must be coordinated with the base radiation office (45

ADMS/SGPH) and base safety (45 SW/SG) for compliance with Air Force, DoD, and federal regulations regarding radiation protection.

3.1.9 Water Supply

The city of Cocoa provides potable water from the Floridan aquifer to central Brevard County. Maximum daily capacity is 44 million gallons per day (mgd), and the average daily consumption is 25 mgd (CBAEDC, 1992). Cape Canaveral AS receives its water supply from the city of Cocoa and uses an average of 0.64 mgd (Burkett, 1994). To support launches, the water supply distribution system at Cape Canaveral AS was constructed to provide peak capacities of up to 30,000 gallons per minute for 10 minutes.

3.1.10 Noise

Noise is most often defined as unwanted sound. Sound levels are easily measured, but the variability is subjective and physical response to sound complicates the analysis of its impact on people. Physically, sound pressure (L_p) magnitude is measured and quantified using a logarithmic ratio of pressures whose scale gives the level of sound in decibels (dB). Because the human hearing system is not equally sensitive to sound at all frequencies, a frequency-dependent adjustment called A-weighting has been devised to measure sound in a manner similar to the way the human hearing system responds. The A-weighted sound level is expressed in "dBA" or "dB(A)."

Several methods have been devised to relate noise exposure over time to community response. The USEPA has developed the day-night average sound level (L_{dn}) as the rating method to describe long-term annoyance from environmental noise. L_{dn} is similar to a 24-hour energy equivalent sound level (L_{eq}). L_{eq} is a single-number sound descriptor representing the average sound level in a real environment, where the actual sound level varies with time. The L_{dn} has a 10-dB penalty for nighttime (10 P.M. to 7 A.M.) sound levels to account for the increased annoyance that is generally felt during normal sleep hours. The USAF and the Department of Housing and Urban Development (HUD) use L_{dn} for evaluating community noise impact.

According to HUD and USAF criteria, residential units and other noise-sensitive land uses are "clearly unacceptable" in areas where the noise exposure exceeds 75 dBA L_{dn}, "normally unacceptable" in areas exposed to L_{dn} of 65 to 75 dBA, and "normally acceptable" in areas exposed to L_{dn} of 65 dBA or less.

The Air Force uses L_{dn} for evaluating their Air Installation Compatible Use Zone (AICUZ) programs. Noise contours can be generated and plotted to define compatible use zones I, II, and III. These zones correspond to L_{dn} values below 65 dBA (zone I), between 65 and 75 dBA (zone II), and above 75 dBA (zone III).

The USEPA has established noise emission control for construction equipment through design and manufacturing standards under the auspices of the Noise Control Act of 1972.

The primary noise generators at Cape Canaveral AS prelaunch processing sites are support equipment, vehicles, and air conditioners. Occasionally, increased noise levels are experienced on a short-term basis when launches occur at one of the launch complexes. Ambient conditions in the prelaunch processing areas are typical of those for an urban commercial business or light industrial area. Because of the configuration of the installation on a barrier island, off-base areas are generally several miles from the launch complexes. For example, the closest off-base area to SLC-36 (used to launch the Atlas II family) is in Cape Canaveral, approximately 5.2 miles to the south.

3.1.11 Cultural Resources

Cape Canaveral AS has been the subject of numerous intensive historic and archaeological surveys in recent years. Among these surveys have been studies by Resource Analysts, Inc., for the Air Force (Barton and Levy, 1984; Levy, Barton, and Riordan, 1984) and more recent and ongoing cultural resource evaluations for National Register eligibility conducted by the Environmental Resources Planning Section of the U.S. Army Corps of Engineers, Mobile, Alabama. There are archaeological and historical sites at Cape Canaveral AS that could be disturbed by construction of new facilities.

SLC-36 was among 21 launch complexes identified as potentially eligible for the National Register of Historic Places (Barton and Levy, 1984). Included among these complexes are ones being considered for use by the EELV program. For SLC-36, a memorandum of agreement between the Air Force, the Florida State Historic Preservation Officer, and the Advisory Council on Historic Preservation dated February 1, 1989, required documentation prior to any alteration, dismantling, demolition, or removal action that could affect SLC-36. In 1994, the Corps of Engineers finalized historical documentation of SLC-36 in accordance with the standards of the Secretary of the Interior (George, 1995).

Cape Canaveral AS contains a National Historic Landmark District comprised of seven non-contiguous sites including SLC-14, SLC-19, SLC-34, the service structure at SLC-13, SLC-26, SLC-5-6, and the Mission Control Center. The facilities that are likely to be used for satellite processing operations are not currently considered eligible for the National Register of Historic Places (George, 1996).

3.1.12 Biological Resources

Near-natural conditions have been retained at Cape Canaveral AS by restricting activities on the station. The majority of the complex consists of vegetation indigenous to Florida: coastal scrub (9,400 acres), coastal strand (2,300 acres), and coastal dune (800

acres) plant communities. Hammocks at Cape Canaveral AS are small in size, totaling less than 200 acres (George, 1987). Wetlands at Cape Canaveral AS include approximately 500 acres of estuarine wetlands and 1,260 acres of freshwater wetlands (Mercadante, 1996). Figure 5 shows vegetation communities at Cape Canaveral AS.

Forty-six special status plant and animal species are associated with Cape Canaveral AS, as shown in Table 5. The USFWS and Florida Game and Fresh Water Fish Commission (FGFWFC) status and sightings are included in this table. Federal and state listed sea turtles and turtle hatchlings are affected by exterior lights. To minimize impacts to sea turtles, Cape Canaveral AS has implemented a lighting policy (included as Appendix A) for management of exterior lights at the installation. This policy requires the use of low-pressure sodium lights unless prohibited by safety or security purposes. All active launch complexes, as well as certain payload processing facilities, have specific light management plans to protect sea turtles.

The sea turtle nesting summary report for 1995 for Cape Canaveral AS (Leach, 1995) includes recent Cape Canaveral AS data as a participant in the FDEP Index Nesting Beach Survey. It documents the results of beach restoration, predator control, and light shielding of sea turtle nests. The Cape Canaveral AS beaches provide prime nesting habitat for green and loggerhead sea turtles. For the eleven years of survey data, 1995 was the highest in nesting activity for both species.

Figure 5 Vegetation Communities at Cape Canaveral Air Station

Table 5 Special Status Species Associated with Cape Canaveral AS

Scientific Name	Common Name	USFWS[2]	STATUS[1] FGFWFC[2]	Cape Canaveral[3]
Amphibians and Reptiles:				
Alligator mississippiensis	American alligator	T(S/A)	SSC	o
Caretta caretta caretta	Atlantic loggerhead turtle	T	T	o
Chelonia mydas mydas	Atlantic green turtle	E	E	o
Dermochelys coriacea	Leatherback turtle	E	E	o
Drymarchon corais couperi	Eastern indigo snake	T	T	o
Gopherus polyphemus	Gopher tortoise	UR2	SSC	o
Lepidochelys kempi	Atlantic ridley turtle	E	E	o
Nerodia fasciata taeniata	Atlantic salt marsh snake	T	T	n/o
Rana areolata	Gopher frog	UR2	SSC	n/o
Birds:				
Ajaia ajaja	Roseate spoonbill	--	SSC	o
Aphelocoma coerulescens	Florida scrub jay	T	T	o
Charadrius melodus	Piping plover	T	T	o
Egretta thula	Snowy egret	--	SSC	o
Egretta tricolor	Louisiana heron	--	SSC	o
Ethene cuniculeria	Burrowing owl	--	SSC	o
Falco peregrinus tundrius	Arctic peregrine falcon	T	T	o
Falco sparverius paulus	Southeastern American kestrel	UR2	T	n/o
Florida oaerules	Little blue heron	--	SSC	o
Grus canadenis pratensis	Florida sandhill crane	--	T	n/o
Haematopus palliatus	American oyster catcher	--	SSC	o
Haliaeetus leucocephalus	Bald eagle	E	T	o
Mycteria americana	Wood stork	E	E	o
Pelecanus occidentalis	Brown pelican	--	SSC	o
Polyborus plancus audubonii	Audubon's crested caracara	T	T	n/o
Sterna antillarum	Least tern	--	T	o
Mammals:				

Peromyscus floridanus	Florida mouse	UR2	SSC	o
Peromyscus polionotus niveiventris	Southeastern beach mouse	T	T	o
Trichechus manuatus latriostris	West Indian manatee	E	E	o

Table 5 Special Status Species, continued

Scientific Name	Common Name	STATUS[1] USFWS[2]	FDA[2]	Cape Canaveral[3]
Plants:				
Acrostichum danaeifolium	Giant leather fern	-	T	o
Asclepias curtissii	Curtis milkweed	-	E	o
Chrysophyllum oliviforme	Satinleaf	-	E	o
Ernodea littoratis	Beach creeper	-	T	o
Glandularia maritima	Coastal vervain	-	E	o
Lechea cernua	Nodding pinweed	-	E	o
Ophioglossum palmatum	Hand fern	-	E	o
Opuntia compressa	Prickly pear cactus	-	T	n/o
Opuntia stricta	Prickly pear cactus	-	T	o
Osmuda regalis var. spectabilis	Royal fern	-	C	n/o
Remirea maritima	Beach star	-	E	o
Scaevola plumeria	Scaevola	-	T	o
Tillandsia simulata	Wildpine; air plant (unnamed)	-	T	n/o
Tillandsia utriculata	Giant wildpine; giant air plant	-	C	o

1 E = Endangered; T = Threatened; T(S/A) = Threatened due to Similarity of Appearance; SSC = Species of Special Concern; UR2 = Under review, but substantial evidence of biological vulnerability and or threat is lacking (formerly Category 2); C = Commercially Exploited.

2 Listing agencies: FDA = Florida Depar tment of Agriculture and Consumer Services; FGFWC = Florida Game and Freshwater Fish Commission; USFWS = United States Fish and Wildlife Service

3 o = observed; n/o = not observed

3.1.13 Health and Safety

Health and safety requirements relevant to the proposed action fall into two areas: industrial hygiene and ground safety. Industrial hygiene is the joint responsibility of bioenvironmental engineering and contractor safety departments, as applicable. Responsibilities include monitoring of exposure to workplace chemicals and physical hazards, hearing and respiratory protection, medical monitoring of workers subject to chemical exposures, and oversight of all hazardous or potentially hazardous operations.

Ground safety includes protection from hazardous situations and hazardous materials. If personal protective equipment must be used, safety requires a general description of the commodity in use; the hazardous qualities of the material; and data showing compliance with allowable limits for airborne vapors for workspace, workplace emergencies, and public exposures.

Health and safety issues relative to nonionizing radiation sources are included in the analysis regarding nonionizing radiation.

The primary launch safety regulation at Cape Canaveral AS is Eastern and Western Range 127-1, Range Safety Requirements. This regulation establishes the framework within which safety issues are addressed, referencing other safety regulations and requiring the preparation of various safety plans. Additional important regulations are Air Force Manual 91-201, “Explosives Safety Standards”; MIL-STD-1522A, “Standard General Requirements for Safe Design and Operation of Pressurized Missile and Space Craft”; MIL-STD-454, Requirement I, “General Requirements for Electronic Devices”; MIL-STD-1576, “Electroexplosive Subsystem Safety Requirements and Test Methods for Space Systems”; Air Force Occupational Safety and Health (AFOSH) Standard 91-XX, Safety Series; and AFOSH Standard 48-XX, Medical Series.

The meteorological environment at Cape Canaveral AS is conducive to numerous lightning strikes. During the summer months, lightning detection systems indicate that 1,400 ± 840 cloud strikes occur per month on the 135-square mile Kennedy Space Center (NASA, 1990).

3.2 STRATOSPHERIC OZONE

The Earth's atmosphere can be described as a series of several vertical strata or layers distinguished by temperature profile, structure, density, composition, and degree of ionization. The boundaries between these atmospheric layers are indistinct and vary with latitude. The troposphere extends up from the surface of the earth to a height ranging from 12 kilometers (km) at the equator to 8 km at the poles. The stratosphere extends from the top of the troposphere to about 50 km above the earth's surface. Most atmospheric ozone is concentrated in a layer in the stratosphere that extends from 15 to 30 kilometers above the earth’s surface.

The stratosphere is the main atmospheric region of O_3 production. The highest O_3 concentrations are found near the middle of the stratosphere at a height of about 25 km. The concentration of O_3 results from a dynamic balance between O_3 transported by stratospheric circulation and O_3 production/destruction mechanisms. Ozone concentrations vary with stratospheric location. Stratospheric circulation carries O_3 from the equatorial regions, where it is produced primarily by chemical reactions, to other

regions of the stratosphere where circulation and homogeneous and heterogeneous chemistry (gas-phase reactions with liquids or solid particles) play an important role.

Even though O_3 is a trace element in the stratosphere, its presence is important because it has the ability to absorb ultraviolet (UV) radiation from the sun. It is able to absorb virtually all UV radiation with wavelengths less than 290 nanometers (nm) and most of the radiation in the harmful 290-320 nm wavelength region (ultraviolet-B [UV-B] region). The stratosphere is considered an important shield against harmful UV radiation. The absorption properties of O_3 present in this layer prevent UV radiation from reaching the Earth's surface in quantities that could be harmful to human health, natural environmental systems, and climate.

Title VI of the Clean Air Act (CAA) Amendments of 1990 reflects Congressional concern that chlorofluorocarbons (CFC), hydrochlorofluorocarbons (HCFC), brominated hydrocarbons (halons), carbon tetrachloride, methyl chloroform, and other chemicals are destroying the stratospheric ozone layer. Even though these chemicals are released in the lower atmosphere (troposphere), their life span is such that they can be transported to the stratosphere through tropospheric mixing. Once in the stratosphere, these compounds are broken down by ultraviolet radiation, producing highly reactive chlorine and bromine radicals which participate in the catalytic destruction of O_3. Title VI (Sections 602-618 of the Clean Air Act, codified at 42 United States Code 7671a-q) requires the phase-out of production and consumption of ozone-depleting substances (ODS), regulates the use and disposal of ODSs, bans nonessential products containing ODSs, requires labeling of products manufactured with and containing ODSs, and regulates their replacement with substitutes so that the stratospheric concentration of chlorine and bromine can be reduced.

The CAA required the USEPA to regulate ODSs in two classes. Class I substances include CFCs, halons, carbon tetrachloride, and methyl chloroform. Class II substances are specifically listed HCFCs. USEPA is required to add substances to the Class I category if they have an ozone depleting potential (ODP) of 0.2 or greater. The ODP is a factor established by USEPA to reflect the ozone-depleting potential of a substance as compared to chlorofluorocarbon-11 (CFC-11). For Class II substances, USEPA is required to add any other substance that is known or may reasonably be anticipated to cause or contribute to harmful effects on the O_3 layer.

The actions detailed in Title VI carry out the United States obligations under the "Montreal Protocol on Substances that Deplete the Ozone Layer." The Montreal Protocol is a treaty, ratified by the U.S. Senate in December 1988, limiting global production and consumption of ODSs. The Montreal Protocol, as embodied in the CAA Amendments of 1990, originally required the production of CFCs to be phased out by January 1, 2000, with the exception of methyl chloroform which had a deadline of

January 2, 2002. Also, effective January 1, 2015, it would be unlawful to sell or consume Class II substances without certain restrictions, and their production would be phased out by January 30, 2030.

During 1992, the parties to the Montreal Protocol amended the treaty to reflect recent scientific information on the harmful effects caused by the destruction of stratospheric O_3. The Montreal Protocol now calls for an accelerated phase-out of CFCs, methyl chloroform and carbon tetrachloride by January 1, 1996, with the exception of critical CFC uses. It called for the phase-out of halons by the end of 1993. Finally the protocol calls for the addition of methyl bromide (a broad spectrum pesticide) and hydrobromofluorocarbons (HBFC) as Class I substances with the phase-out of methyl bromide by January 1, 2001, and HBFCs by January 1, 1996. The USEPA has elected to accelerate the phase-out of the three Class II HCFCs with the highest ODP: HCFC-141B, HCFC-22, and HCFC-142B. The USEPA will ban the production and consumption of HCFC-141B as of January 1, 2003, and the production and consumption of HCFC-142B and HCFC-22 by January 1, 2020. The USEPA will ban the production and consumption of all other HCFCs by January 1, 2030. The USEPA has incorporated the accelerated phase-out and additions called for by the amendments in its final rule on the protection of stratospheric O_3, published in 58 Federal Register (FR) 65018-65082 (Dec. 10, 1993) and codified at 40 CFR Part 82. Ultimately, the goal is to reverse the observed reduction in global O_3 and limit resulting damage to the Earth from increased UV radiation.

3.3 GEOSYNCHRONOUS EARTH ORBIT

The Earth's orbital space is a global resource used for many purposes by humanity, including remote sensing, communications, and navigation. The most valuable part of this resource is GEO, which is used by communications, weather, and military satellites. GEO is widely used because a satellite placed in that orbit is essentially stationary relative to a point on the Earth's surface. Because of potential communication interference, the number of satellites that can use GEO is effectively limited to 180. GEO is managed by the International Telecommunications Union through allocation of radio frequencies (WCED, 1996).

SECTION 4

ENVIRONMENTAL CONSEQUENCES

This section describes potential impacts that would occur under various federal actions. Potential impacts are addressed for the proposed action and the no action alternative. Since the final configuration of the program has not been established, this analysis is based on the most recent available information or on conservative assumptions where information was not available.

This section includes impact analysis for Cape Canaveral AS, Florida, since prelaunch processing of the satellites and launches will occur at that location. Specific impact analysis for the various ground facilities is not included since these activities are similar to other actions that have been determined to have insignificant impacts or would be located on other bases or locations with similar facilities that have been determined to have insignificant impacts.

4.1 GEOSYNCHRONOUS EARTH ORBIT SATELLITES

For the proposed action, the wet weight of the satellite would be approximately 8,000 pounds fueled by a dual mode propulsion system. After the satellite had been injected into geosynchronous transfer orbit by the launch vehicle, the propulsion system would utilize thrusters with hydrazine as fuel and nitrogen tetroxide as an oxidizer to insert the satellite into GEO. Once GEO had been achieved, hydrazine would be used exclusively for orbital maintenance. The satellite would carry approximately 2,300 pounds of hydrazine and 1,600 pounds of nitrogen tetroxide.

Helium would be utilized as the pressurant for satellite systems. The fuel, oxidizer, and helium would be carried in five titanium or composite overwrap metal tanks. Batteries would be nickel hydrogen. There would be no ionizing radiation sources, but the satellite would include antennas which would be nonionizing radiation sources.

For the alternative action, the wet weight of the satellite would be approximately 6,500 pounds with nitrogen tetroxide as the oxidizer and either monomethyl hydrazine or hydrazine as fuel. The satellite would carry approximately 1,400 pounds of fuel and 2,300 pounds of nitrogen tetroxide.

Helium would be utilized as the pressurant for satellite systems. The fuel, oxidizer, and helium would be carried in six fiberglass wrapped stainless steel tanks. Batteries would be nickel hydrogen. There would be no ionizing radiation sources, but the satellite would include antennas which would be nonionizing radiation sources.

4.1.1 Air Quality

Impacts to air quality may be considered significant if the federal action resulted in violation of a NAAQS, contributed to an existing or projected air quality violation, exposed sensitive receptors to substantial pollutant concentrations, exceeded de minimis quantities in nonattainment areas, represented a criteria pollutant increase of more than ten percent within a nonattainment or maintenance area, or exceeded any significance criteria established by a state implementation plan. Requirements under the Emergency Planning and Community Right-to-Know Act (EPCRA) are addressed in the sections on hazardous materials and pollution prevention.

Proposed Action

Estimated emissions are not calculated for facilities indirectly involved with SBIRS satellite processing, including remote propellant storage locations, antenna sites, and other areas which support the entire installation. Sources at these facilities (i.e., boilers and generators) are considered specific to the individual facilities and would normally generate emissions in the absence of the proposed action. Emissions from these sources are included in the baseline emissions presented in Section 3.

All sources proposed for operation will have the appropriate permits or be exempt from permitting. The potential impacts of permitted sources on air quality would be evaluated by the FDEP during the permitting process. The permit requirements would reflect the results of the FDEP analysis of emission levels that would not adversely affect air quality. Likewise, FDEP conditions for exempting sources from permitting also reflect emission levels that would not adversely affect air quality. As such, emissions from exempt sources would be considered by FDEP to have no adverse effect on ambient air quality. Contractors at Cape Canaveral AS are required to report VOC emissions to 45 CES/CEV for compliance with the CAA, Title V.

Typical emission sources at a satellite prelaunch processing facility would include a boiler, a generator, a diesel aboveground storage tank (AST), fuel and oxidizer scrubbers, and the use of materials containing VOCs. The boiler, generator, AST, and majority of the volatile materials would be used for facility operation and maintenance. The oxidizer and fuel scrubbers as well as isopropyl alcohol (IPA) would be used for direct support of SBIRS satellites prelaunch processing.

The analysis in this section will be based on the DPF and the DSCS III satellite. The DPF is an existing facility currently used for prelaunch processing of DSCS III and

NAVSTAR Global Positioning System Block IIR satellites. The DPF has operating permits for fuel and oxidizer scrubbers, and for its boiler. Other sources are exempt from FDEP permitting requirements. Emissions associated with satellite processing in the DPF have been previously estimated for the DSCS III program (USAF, 1995). The DSCS III satellite with its integrated apogee boost system utilizes monopropellant hydrazine and monomethyl hydrazine (MMH) as fuel, and nitrogen tetroxide as the oxidizer with the MMH. The DSCS III is a GEO satellite with a weight of 5,910 pounds, including propellants. The SBIRS satellite emissions factors should be similar to the DSCS III satellites. To assure a conservative analysis, the assumption will be made that each GEO satellite would carry a fuel and oxidizer load double that of the DSCS III satellite. As shown in Table 6, total annual emissions for up to four missions in a year for criteria pollutants would be less than one ton for each pollutant and no more than 0.0083 percent of baseline permitted emissions for Brevard County for any pollutant.

In conclusion, the anticipated air emissions from SBIRS satellite processing are not expected to violate the NAAQS, the Florida ambient air quality standards, or FDEP air toxics regulations, and would contribute insignificantly to existing air quality in the area. Assumptions regarding minor emission quantities are based on studies performed inventorying air emissions from similar sources at other installations. FDEP indicated that there are no ongoing enforcement actions or compliance problems at the installation (FDEP, 1996).

No Action Alternative

Under the no action alternative, there would be no change in the baseline conditions described in Section 3.

Table 6 Estimated Emissions from the Proposed GEO Satellites

	Pollutant Emissions (tons per year)					
Emissions Source	**NO_x**	**SO_x**	**CO**	**PM10**	**VOC**	**Lead**
Permitted Sources						
Boiler	0.30	0.87	0.08	0.03	0.01	0.00
Fuel scrubber	--	--	--	--	1.51×10^{-7}	--
Oxidizer scrubber	1.21×10^{-6}	--	--	--	--	--
Subtotal	**0.30**	**0.87**	**0.08**	**0.03**	**0.01**	**0.00**
Non-permitted Sources						
Standby generator	0.42	0.06	0.10	0.01	0.01	0.00
AST	--	--	--	--	0.001	--
Materials with VOCs	--	--	--	--	0.42	--
Subtotal	**0.42**	**0.06**	**0.10**	**0.01**	**0.43**	**0.00**
Total emissions	**0.72**	**0.93**	**0.18**	**0.04**	**0.44**	**0.00**
Brevard County Baseline	**9,498**	**32,943**	**960**	**2,366**	**581**	**NR***
Percent Contribution of Permitted Sources	**0.0032**	**0.0026**	**0.0083**	**0.0013**	**0.0017**	**0.00**
Percent Increase of Nonpermitted Sources	**0.0044**	**0.0002**	**0.0104**	**0.0004**	**0.0740**	**0.00**

* NR = not reported.

4.1.2 Water Resources

An impact to water resources may be considered significant if the federal action interfered with drainage, exceeded the capacities of the regional supply systems, or resulted in degradation of surface water quality such that existing defined surface water uses would be impaired.

Proposed Action

Satellite processing activities would take place within structures and precautions will be taken to prevent and control spills of hazardous materials in accordance with 45 SW OPlans 19-1 and 32-3. Large spills of satellite fuel will be controlled through catchment systems in the processing facility. The catchment systems and holding tanks are for emergency purposes only (large spills) and are not routinely used. Therefore, these systems are not regulated as hazardous waste tank systems.

Since no new facilities would be constructed under the proposed action, storm water permits from the Saint Johns River Water Management District are not required. The existing facilities are covered under the current Cape Canaveral AS storm water pollution prevention plan.

No Action Alternative

Under the no action alternative, there would be no change in the baseline conditions described in Section 3.

4.1.3 Solid Waste

Solid waste impacts may be considered significant if the federal action resulted in noncompliance with applicable regulatory guidelines or increased the quantities of solid waste generated beyond available waste management capacities.

Proposed Action

Solid waste would be generated by satellite processing activities as well as by personnel associated with those activities. Drums and dumpsters are used for temporary storage of solid waste. Containers are removed or emptied by the Cape Canaveral AS solid waste contractor. The satellite contractor shall participate in the white paper, cardboard, and aluminum can recycling program in place at Cape Canaveral AS. Participation in this program will reduce the total solid waste that would have been generated.

Assuming a maximum of 50 temporary personnel, a design solid waste generation rate of 3 pounds per person per day, and a maximum of 60 working days at the processing facility, satellite processing personnel would generate up to an estimated 4.5 tons of solid waste during the period. In addition, satellite processing activities would generate less than 0.5 tons of non-hazardous solid waste for a total solid waste generation rate of approximately 5.0 tons per satellite. For four satellites processed in a single year, a total of 20 tons would be produced. This represents an increase of 1.01 percent over the current solid waste generation rate of 1,986 tons per year for Cape Canaveral AS.

No Action Alternative

Under the no action alternative, there would be no change in the baseline conditions described in Section 3.

4.1.4 Hazardous Materials

Hazardous materials impacts may be considered significant if the federal action resulted in noncompliance with applicable regulatory guidelines.

Proposed Action

The contractor would conduct nearly all of the satellite processing operations at a contractor facility prior to transport of the satellites to Cape Canaveral AS. This excludes fueling operations, antennae testing, and minor tests or adjustments required after transport. As such, significant quantities of hazardous materials would not be used

at Cape Canaveral AS other than those required to support the aforementioned operations.

Materials are typically classified as hazardous based on one or more of four major characteristics: toxicity, ignitability, reactivity, and corrosivity. The potential impacts to humans and the environment associated with transporting, storing, and dispensing hazardous materials are primarily a reflection of these characteristics. Toxicity is the tendency of a material to affect the health of a living organism through chemical interaction with the organism's biological systems. Ignitability is the capability of a material to cause fire when exposed to a specific environmental stimulus such as friction, absorption of moisture, or spontaneous chemical changes. Reactivity is a characteristic of certain materials which causes them to readily undergo violent change under a chemical or physical stimulus such as exposure to air, water, a strong heat source, or a strong oxidizer. Corrosivity describes one material's ability to degrade another material, and is typically a characteristic of highly acidic or alkaline materials. Other characteristics of hazardous materials exist, but most apply to special circumstances. For example, cryogens, such as liquid nitrogen, would be considered hazardous due to their extremely low temperature.

All hazardous materials used for satellite processing shall be transported, stored, and dispensed in accordance with Occupational Safety and Health Administration (OSHA) 29 CFR 1926, and AFOSH Standards 91-XX (Safety) and 48-XX (Health), as well as applicable federal, state, and local regulations governing the transport, storage, and use of hazardous materials. These regulations consider the inherent danger of hazardous materials to health, safety, and the environment, and if hazardous materials are handled according to regulations, minimal impacts should occur. In general, aside from minor air emissions associated with solvents, coatings, and adhesives use, no other impacts are expected from the normal use of hazardous materials under the proposed action in accordance with applicable regulations.

No baseline use of hazardous materials was available for Cape Canaveral AS. As such, potential effects from hazardous materials for the proposed action are analyzed according to their hazard characteristics.

Fuels and oxidizers represent the most potentially dangerous group of hazardous materials used during satellite processing and have potential impacts associated with all four hazard characteristics. Hydrazine and nitrogen tetroxide are toxic, highly reactive, ignitable, and corrosive. The specific procedures that would be utilized during propellant loading have not been fully developed at this time; however, procedures are expected to be similar to those for other spacecraft (e.g., DSCS III). Hydrazine and nitrogen tetroxide would be stored at Fuel Storage Area 1 (FSA-1) and delivered to the processing facilities in approved containers by the JPC when needed. Fuel and oxidizer loading would be conducted separately. As much as 3,000 pounds of hydrazine and 3,000 pounds of

nitrogen tetroxide would be loaded into the satellite. Hydrazine and nitrogen tetroxide vapor emissions would be controlled by separate packed-column air scrubbers. After hydrazine and nitrogen tetroxide transfers occurred, empty containers will be returned to FSA-1. During hydrazine and nitrogen tetroxide handling, all applicable safety standards (evacuation of nonessential personnel, use of protective gear) shall be in force to mitigate health and safety hazards, and no impacts are anticipated if these standards are followed during normal fuel and oxidizer processing.

Process liquids used during satellite processing would likely include a 14 percent citric acid solution, which is used in the hydrazine packed-column air scrubber, and a 25 percent sodium hydroxide solution, which is used in the oxidizer packed-column air scrubber. Both represent potential hazards associated with toxicity and corrosivity. Citric acid and sodium hydroxide solutions would be contained in the respective air scrubbers and would not be accessible to the environment or to human contact. Trained personnel dispensing the solutions into the scrubbers will take all precautions, including the use of protective wear, to ensure they are not exposed. No impacts are expected during satellite processing from the normal use of process liquids.

It is anticipated that process gases (air, argon, helium, gaseous and liquid nitrogen, and propane) would be used during satellite processing for fuel line purging and miscellaneous operations which require pressurized gases. Potential impacts are associated with reactivity and ignitability. Process gases are stored under high pressure and can react violently and explosively when exposed to air through a container puncture or when exposed to an ignition source. To minimize this danger, pressurized gases are contained in thick metal cylinders designed to withstand punctures and prevent exposure to ignition sources. These pressure vessels comply with DOT standards to ensure safety. In addition, the gases will be stored in designated approved storage areas when not in use to further minimize the potential for hazard. Cryogenic liquid nitrogen is considered a potential hazard due to the extreme low temperature at which it is stored and used. Standard health and safety precautions will be taken when using liquid nitrogen to ensure that personnel are not exposed. No impacts are expected from the normal use of process gases and cryogens by trained personnel during satellite processing.

Oils and lubricants would be used for facility maintenance during spacecraft processing. All would be stored in small amounts in approved POL storage lockers. Quantities needed would vary, and supplies would be ordered and maintained as necessary. Oils and lubricants would have potential hazards associated with toxicity if ingested or released to the environment. However, impacts to human health and the environment are unlikely from normal use of these materials if they are dispensed and stored in accordance with applicable health and safety standards.

Protective coatings might also be used in relatively small amounts at the PSTF for facility maintenance. These materials present potential hazards due to their toxicity and ignitability. Typical use of coatings during maintenance will release small amounts of volatile constituents as part of the drying process. All coatings will be used in well-ventilated areas to prevent concentration of hazardous vapors. Additionally, necessary safety precautions will be taken to prevent the ignition of vapors. When not in use, coatings will be stored in approved flammable materials storage lockers. Supplies would be ordered and maintained as necessary. With the exception of minor air emissions, no other impacts are anticipated from the normal use of protective coatings and resins during satellite processing.

Solvents and cleaning materials are expected to be used for miscellaneous wipe cleaning and thinning of coatings. All are volatile and can be expected to release small amounts of vapors in the immediate area where they are used. Solvents and cleaning materials will be used in well-ventilated areas to prevent buildup of vapors, and precautions will be taken to prevent ignition of vapors. All solvents and cleaning materials will be stored in small quantities in approved flammable materials storage lockers. With the exception of minor air emissions, no other impacts are anticipated from the normal use of solvents during satellite processing.

Several of these compounds or their constituents are targeted chemicals on the USEPA priority pollutant list of 17 industrial toxics (EPA-17). This list was developed to identify chemicals used throughout industry that are judged to be of the greatest concern due to their toxicity and effect on the environment. Air Force policy is committed to reducing purchases of industrial toxics in 1996 by 50 percent from the 1992 baseline. Additionally, the USEPA has established a voluntary reduction program, called the 33/50 program, which aims to promote voluntary reduction of EPA-17 priority pollutants by 50 percent in 1995 with an interim goal of 33 percent by 1992. EPA-17 chemicals used during satellite processing include toluene and xylene, which are typical constituents of lacquer thinner and coatings. These chemicals would be used only in small quantities (if at all) for miscellaneous thinning and coating.

The contractor for the SBIRS satellites would be encouraged to participate in the hazardous materials pharmacy at Patrick AFB as necessary for procurement of hazardous materials. Hazardous material spill prevention and control for satellite processing activities shall be in accordance with 45 SW OPlans 19-1 and 32-3.

No Action Alternative

Under the no action alternative, there would be no change in the baseline conditions described in Section 3.

4.1.5 Hazardous Waste

Impacts to hazardous waste management may be considered significant if the federal action resulted in noncompliance with applicable regulatory guidelines or increased the amounts generated beyond available waste management capacities.

Proposed Action

Hazardous materials associated with satellite processing can potentially generate hazardous waste. The contractor for the satellites is responsible for identification, containerization, labeling, and accumulation of hazardous wastes in accordance with all applicable federal, state, and local regulations, and with 45 SW OPlan 19-14. All hazardous wastes generated from satellite processing activities will be transported, treated, stored, and disposed (or arrangements made for disposal) by the JPC.

A forecast of anticipated hazardous waste streams associated with the proposed action is presented in Table 7 for four launches in a year. Actual hazardous waste streams that would be generated by the SBIRS satellite processing activities are currently unknown. Where appropriate, forecasts were made based on waste streams generated by processes for similar spacecraft programs (e.g., DSCS III).

Liquid wastes are expected to be generated almost exclusively from fuel and oxidizer transfer operations using separate propellant transfer equipment. After loading hydrazine or monomethyl hydrazine into the satellite, transfer equipment and lines are expected to be flushed first with potable water and then with an IPA and demineralized water mixture. Potable water is expected to be used to flush oxidizer transfer equipment and lines after nitrogen tetroxide has been transferred to the satellite. The first three rinses of potable water for nitrogen tetroxide lines and equipment are considered hazardous waste. Further rinses with IPA and demineralized water may or may not be hazardous waste depending on the waste characterization. Approximately 5 gallons of sodium hydroxide solution used for soaking small oxidizer transfer equipment parts (seals, fittings, etc.) is expected to be added to the oxidizer rinse water. Rinse streams would be collected in separate, approved DOT 5C 55-gallon containers. As required, the contractor will arrange with the JPC to immediately remove wastes as they are generated or arrange with the LBSC to establish a satellite accumulation point at the processing facility for extended accumulation.

Table 7 Annual Hazardous Wastes Forecast for Proposed GEO Satellites

Waste Description	Estimated Volume of Waste (lb/yr)[a]
Liquid Hazardous Wastes	
Potable water rinsate of hydrazine transfer equipment	1,834
IPA and demineralized water rinsate of hydrazine transfer equipment	1,834
Potable water rinsate of nitrogen tetroxide transfer equipment	1,834
Sodium hydroxide (oxidizer scrubber solution) [b]	6,251
Hydrazine mixture collected from liquid separator on scrubber [c]	220
Solid Hazardous Wastes	
Pads, wipes, and other solids contacting hydrazine	112
Pads, wipes, and other solids contacting nitrogen tetroxide	112
Total Exclusive of Reclaimed Propellant	11,977
Baseline Cape Canaveral AS	676,000
Percent of Baseline from Proposed Action	1.77

Source: USAF, 1995.

[a] Amounts presented account for four missions per year .

[b] Sodium hydroxide scrubber solution will actually be changed approximately once every 5-10 years. The amount presented reflects the total amount that will be wasted when the solution is changed.

[c] The hydrazine is reclaimed and not included in the annual hazardous waste total used for comparison with the baseline hazardous waste generated annually at Cape Canaveral AS. Similar quantities would be generated if another fuel such as monomethyl hydrazine were used.

The fuel and oxidizer rinsate wastes may or may not be hazardous depending on how the waste was generated and/or the characteristics of the wastes. Waste from each drum will be sampled and characterized based on laboratory analysis and the generation process. Based on the results of the waste characterization, drums will be labeled as hazardous or non-hazardous and disposed of accordingly by the JPC. Nonhazardous fuel rinsate can be disposed of in the Hypergolic Propellants Incinerator operated by the JPC under air permits obtained from FDEP. Nonhazardous oxidizer wastes can be neutralized and discharged to the sanitary sewer in accordance with a variance for disposal of liquid oxidizer wastes.

Sodium hydroxide solution used in the oxidizer scrubber would be changed approximately once every five to ten years. As requested, the JPC would pump the spent scrubber solution into approved containers, and label and dispose the waste accordingly after testing to determine the waste characterization of the liquid. The citric

acid solution used in the fuel scrubber would be collected and disposed by the JPC as non-hazardous waste. Fresh scrubber solutions will be provided by the JPC.

During gaseous nitrogen purging of equipment and lines used to transfer hydrazine to the satellite, liquid droplets remaining in the equipment are expected to be collected by a liquid separator as the air streams pass through the hypergolic vent scrubber system. This hydrazine (approximately 5 gallons) will be transferred from the liquid separator to an approved 5-gallon container and collected by the JPC. The JPC will arrange for the reclamation of the fuel for future use.

Solid hazardous wastes would also be generated from fuel and oxidizer transfer operations. Pads, wipes, and other solids are expected be used to clean drips of hydrazine and nitrogen tetroxide. Solids coming into contact with a fuel or oxidizer will be double-bagged and placed in an approved DOT 21C 14-gallon container. A separate container will be used for fuel and oxidizer. Containers will be labeled as hazardous waste and accumulated in the waste fuel and oxidizer areas outside the processing facility until collected by the JPC. Because solids contaminated with nitrogen tetroxide are acutely toxic hazardous waste, these containers will be moved from the processing facility to a 90-day waste accumulation facility within 72 hours in accordance with 45 SW OPlan 19-14 if amounts exceed one quart.

The operations involved in propellant transfer for MMH would be identical to those described for hydrazine. The hazardous waste quantities should be substantially similar regardless of the quantity of fuel or oxidizer since the waste is primarily generated during cleanup. Cleanup operations generally produce the same amount of waste, regardless of quantities transferred. Because solids contaminated with MMH are acutely toxic hazardous waste, containers associated with this fuel will be moved from the processing facility to a 90-day waste accumulation facility within 72 hours in accordance with 45 SW OPlan 19-14 if amounts exceed one quart.

No Action Alternative

Under the no action alternative, there would be no change in the baseline conditions described in Section 3.

4.1.6 Pollution Prevention

An impact on pollution prevention may be considered significant if the federal action affected the ability of the installation to achieve pollution prevention goals.

Proposed Action

No Class I ODSs would be used in the processing facility. Small quantities of materials that contain EPA-17 targeted industrial toxics may be used during satellite

processing. These include coatings and thinners which typically contain toluene and xylene.

Toluene and xylene are also listed chemicals under Emergency Planning and Community Right-to-Know Act (EPCRA) section 313. Although toluene and xylene amounts for the proposed action would not exceed the usage threshold of 10,000 pounds, each will contribute to the total amounts of toluene and xylene used at the entire facility. If toluene or xylene usage at Cape Canaveral AS as a whole exceeds the reporting threshold, release pathways for each chemical in exceedance will have to be documented in the toxic release inventory Form R reports submitted to the USEPA. Therefore, contractors at Cape Canaveral AS must track all EPCRA-listed chemicals and report emissions to 45 CES/CEV. A separate Form R report is required for each exceeding chemical. Since toluene and xylene are expected to be found exclusively in thinners and coatings at the processing facility, the entire quantity of each will be released to the air during usage of the materials and should be reported as a release.

The SBIRS GEO satellite program shall comply with the PPMAP being developed by Cape Canaveral AS. Compliance with the PPMAP will minimize pollution and meet the regulatory requirements relative to pollution prevention.

No Action Alternative

Under the no action alternative, there would be no change in the baseline conditions described in Section 3.

4.1.7 Nonionizing Radiation

Nonionizing radiation impacts may be considered significant if personnel would be exposed to levels of radiation in excess of the maximum permissible exposures recommended by the IEEE (IEEE, 1992).

Proposed Action

Specific design parameters for the antennas that would be installed on the satellites have not been determined. Typically, communications compatibility testing is performed during satellite processing operations. This generally involves radio frequency transmissions from the satellite antennas through an antenna on the roof of the processing facility to the Eastern Vehicle Checkout Facility (EVCF) antennas on the roof of the Satellite Assembly Building (SAB) in the Cape Canaveral AS industrial area. From the EVCF, transmissions are made through the Transportable Vehicle Checkout Facility (TVCF) antenna to the AFSCN to test communications between the satellite and the AFSCN.

An antenna on the processing facility, the 8-foot and 4-foot EVCF antennas on the SAB, and the 23-foot antenna on the TVCF will be used to test the satellites' network

links with ground control facilities. The TVCF antenna has been previously assessed and determined to have no significant radio frequency radiation impacts, including additive impacts with the EVCF antennas (USAF, 1993b). Analysis of the TVCF is not included in this EA.

Previous analyses for antennas on processing facilities has shown that levels of radiation in excess of the MPEs are limited to the roof of the facilities (USAF, 1994a; USAF, 1994c). Antennas on the satellites have antenna "hats" installed that would reduce the levels of radiation below the MPEs within a few feet of the antennas. Personnel clear zones are then established around the satellite antennas when transmissions are occurring.

Therefore, assuming established procedures at Cape Canaveral AS are followed, exposure of personnel to levels of nonionizing radiation in excess of the MPEs is not expected to occur. All activities generating nonionizing radiation shall be coordinated with the base radiation office (45 ADMS/SGPH) and base safety (45 SW/SG) for compliance with Air Force, DoD, and federal regulations regarding radiation protection.

No Action Alternative

Under the no action alternative, there would be no change in the baseline conditions described in Section 3.

4.1.8 Cultural Resources

Impacts to cultural resources may be considered significant if the federal action resulted in disturbance or loss of values or data that qualify a site for listing in the NRHP; substantial disturbance or loss of data from newly discovered properties or features prior to their recordation, evaluation and possible treatment; or substantial changes to the natural environment or access to it such that the practice of traditional cultural or religious activities would be restricted. For purposes of this EA, potentially eligible resources are given the same consideration as listed and eligible resources.

Proposed Action

Cultural resources impacts are site-specific. Full compliance with Section 106 of the National Historic Preservation Act will occur. Significant impacts are not anticipated for payload processing facilities.

No Action Alternative

Under the no action alternative, there would be no change in the baseline conditions described in Section 3.

4.1.9 Biological Resources

An impact to biological resources may be considered significant if the federal action would adversely impact a threatened or endangered species, substantially diminish habitat for a plant or animal species, substantially diminish a regionally or locally important plant or animal species, interfere substantially with wildlife movement or reproductive behavior, and /or result in a substantial infusion of exotic plant or animal species.

Proposed Action

Prelaunch processing of the SBIRS satellites would occur in an existing facility. Adjacent habitats would not be disturbed. Since potential effects of lighting associated with facilities at Cape Canaveral AS is a concern for endangered sea turtles, a lighting policy for management of exterior lights and emphasis on the use of low-pressure sodium lights has been implemented. Lights which emit ultraviolet, violet-blue, and blue-green wavelengths disorient sea turtle hatchlings on the beach. The disoriented hatchlings move inland rather than seaward and suffer increased mortality. Exterior lighting at all facilities used for satellite processing shall conform with this policy.

There are anticipated to be no exterior modifications to the payload processing facilities, disturbances to adjacent grounds, or changes in existing activities. Biological activity, habitats, or species of concern at Cape Canaveral AS will not be affected beyond existing baseline conditions. Therefore, consultation with the U.S. Fish and Wildlife Service under Section 7 of the Endangered Species Act would not be required.

No Action Alternative

Under the no action alternative, there would be no change in the baseline conditions described in Section 3.

4.1.10 Health and Safety

An impact may be considered significant if it would create a public health hazard.

Proposed Action

In addition to the general safety regulations and standards enumerated in Section 3, satellite processing safety would be considered in an Accident Risk Assessment Report for the satellite and the pad safety plan for the processing facility. Safety concerns regarding satellite processing operations can generally be divided into injury to personnel and damage to property.

Possible impact to health and safety include injuries and/or property damage. These impacts may arise from accidents involving transport vehicles delivering or manipulating system components. Additionally, contact of employees with electrically charged components, exposure to hazardous levels of radio frequency radiation or materials, failure of pressurized components, etc. may cause injuries as would normal workplace

hazards. Injuries from catastrophic system malfunctions or reentry of system components are highly improbable (Aerospace, 1992).

Mishaps during air transport of the satellite are unlikely since flight crews are constantly trained in operation and safety of the aircraft. Ground transport accidents are also unlikely because of the low speeds, precautions, and times when transport occurs. The satellite would be transported to the processing facility without propellants.

Safety concerns will be considered in planning for prelaunch processing and launch. Detailed procedures and training for all hazardous processes will be prepared and implemented. The 45th Space Wing Director of Safety will review and approve all safety procedures. Orbital reentry of the satellites would not happen unless an accident occurs during orbital insertion.

No Action Alternative

Under the no action alternative, there would be no change in the baseline conditions described in Section 3.

4.1.11 Geosynchronous Earth Orbit

Proposed Action

The four GEO satellites would occupy approximately 2.2 percent of the available GEO satellites slots and would ultimately replace the DSP satellites as the DSP satellites reach the end of their useful life and are moved to disposal orbits.

No Action Alternative

Under the no action alternative, there would be no change in the baseline conditions described in Section 3.

4.1.12 Cumulative Impacts

Cumulative effects result from the incremental effect of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time. Since the no action alternative does not involve any specific change from baseline conditions, no cumulative effects would occur for this alternative.

The various proposed ground facilities would entail impacts similar to past actions with insignificant impacts and would be situated in installations with existing facilities that are similar in nature. No significant cumulative impacts would be anticipated.

Cape Canaveral AS accommodates various ongoing space programs and will be used for launch of the GEO satellites. The environmental effects associated with these other programs have been included in the baseline environmental conditions (Section 3).

Forecasts of future launches are shown in Table 8 (USAF, 1996b). These projections include all anticipated commercial and government launch operations. The number of launches is anticipated to marginally decrease by 2002.

The addition of up to four Atlas IIAS launches in 2002 would increase the number of launch operations (with associated satellite processing) back to the FY96 levels. The Atlas IIAS has less environmental impact than other LVs in Table 8 because of the small SRMs and the liquid propellants used (Aerospace, 1995). Because of the large SRMs, the Titan IV SRMU has a substantially greater impact than an Atlas II or IIAS. The SBIRS satellites would use propellant types that are commonly used at Cape Canaveral AS. Therefore, significant cumulative impacts are not anticipated.

Table 8 Forecast Launch Activity at Cape Canaveral AS/Kennedy Space Center

Vehicle	FY96	FY97	FY98	FY99	FY00	FY01	FY02
Space Shuttle	8	7	7	7	7	7	7
Atlas	10	8	7	4	7	5	5
Delta	6	11	7	10	6	7	9
Titan	3	3	3	2	2	3	2
Lockheed LV	0	0	2	2	2	2	2
SLBM Ops[1]							
Trident I	2	2	1	1	1	1	2
Trident II	4	3	2	2	2	2	2
UK Trident II	0	1	1	0	1	0	0
TOTALS	**33**	**35**	**30**	**28**	**28**	**27**	**29**

[1] Submarine Launched Ballistic Missile (SLBM) operations typically involve multiple launches.

4.2 LAUNCH VEHICLE

As indicated in Section 2, the baseline launch vehicle (LV) for the GEO satellite constellation is the Atlas IIAS, which is a medium launch vehicle. The Atlas IIAS is the current launch vehicle best suited to carrying this size payload but it may be replaced by the EELV. If the EELV is chosen to substitute for the current launch system, that decision is independent of this action and will be assessed separately in another EIAP. First delivery of GEO satellites is anticipated in fiscal year 2002 (FY02) for a launch some time after delivery.

The environmental analysis in this overview EA is primarily based on previous analyses performed for the commercial Atlas IIAS (USAF, 1991), the Medium Launch

Vehicle II program (USAF, 1989a), and the Medium Launch Vehicle III program (USAF, 1994c) which evaluated effects associated with the Delta II LV.

The Atlas IIAS uses a core vehicle consisting of a booster section and a sustainer section, which together comprise 1-1/2 stages using propellants from the same tanks. The core vehicle uses 108,000 pounds of Rocket Propellant 1 (RP-1) as fuel and 242,000 pounds of liquid oxygen as oxidizer. RP-1 is a kerosene hydrocarbon. Hydrazine-fueled thrusters provide roll control. The Atlas IIAS uses a Centaur II upper stage which is fueled by 5,692 pounds of liquid hydrogen and uses 31,308 pounds of liquid oxygen as oxidizer. Additionally, approximately 210 pounds of hydrazine fuels small catalytic thrusters that provide reaction and roll control for the core vehicle and the Centaur II. Four solid rocket motors (SRM) contain 22,300 pounds of hydroxyl terminated polybutadiene (HTPB) each as fuel with the casing constructed of steel.

For purposes of this assessment, it will be assumed that the SBIRS GEO constellation would have up to four launches in a single year, with a total of eight launches.

4.2.1 Air Quality

Impacts to air quality may be considered significant if the federal action resulted in violation of a NAAQS, contributed to an existing or projected air quality violation, exposed sensitive receptors to hazardous pollutant concentrations, exceeded de minimis quantities in nonattainment areas, represented a criteria pollutant increase of more than ten percent within a nonattainment or maintenance area, or exceeded any significance criteria established by a state implementation plan. Baseline information concerning Cape Canaveral AS air quality is in Section 3.3.2. Requirements under the Emergency Planning and Community Right-to-Know Act (EPCRA) are addressed in the sections on hazardous materials and pollution prevention.

Proposed Action

Typical prelaunch processing effects would occur from backup electric generators, a paint spray booth, and propellant loading systems (USAF, 1989a).

Backup electric generators are permitted by FDEP. FDEP has determined that operation of permitted sources in accordance with permit operating parameters will produce no adverse effects on ambient air quality. Total estimated annual emissions from backup generators would be as follows (USAF, 1989a):

Sandblasting and painting would be performed in a paint-spray booth with a filtered vent system. Volatile organic compounds and particulate matter would be generated (USAF, 1989a). A paint booth would typically be subject to the permitting requirement of the FDEP, which would not issue permits for facilities that would be expected to adversely affect air quality.

Table 9 Atlas Backup Generator Emissions

Pollutant	Tons per Year
Nitrogen oxides	9.3
Carbon monoxide	2.0
Volatile organics	0.7
Particulate matter	0.7
Sulfur dioxide	0.6

The RP-1 fueling system for the Atlas is a closed system and adverse effects on air quality are not expected to occur. Approximately 210 pounds of hydrazine would be loaded into the reaction control system of the Centaur II and the roll control system on the Atlas II interstage. Venting from the hydrazine loading system would occur through a scrubber. The scrubber would typically be subject to the permitting requirement of the FDEP, which would not issue permits for facilities that would be expected to adversely affect air quality.

The potential effects of permitted sources on air quality are evaluated by the FDEP during the permitting process. The permit requirements would reflect the results of the FDEP analysis of emission levels that would not adversely affect air quality.

Launch Emissions. In this section, the results of sampling and modeling studies will be presented and the potential effects on humans will be addressed. The potential effects on biological resources and water quality will be addressed in those sections. Rocket launches are not regulated under the Clean Air Act.

During liftoff, two of the four SRMs and the main engine would be ignited. The anticipated combustion products from the solid rocket motors at the exhaust nozzle exit are presented in Table 10. The remaining two SRMs would be ignited approximately. one minute into the flight. The primary products would be aluminum oxide (Al_2O_3), carbon monoxide (CO), hydrochloric acid or hydrogen chloride (HCl), nitrogen oxides (NO_x), water (H_2O), and carbon dioxide (CO_2).

In the lower atmosphere, the primary detectable products would be Al_2O_3, HCl, CO, and H_2O. Because of the initial high temperatures and abundant oxygen, the carbon monoxide should rapidly oxidize to CO_2.

The anticipated combustion products at the core vehicle main engine exhaust nozzle are shown in Table 11. In the lower atmosphere, H_2O and CO_2 would be the main products since CO should rapidly oxidize to CO_2.

These exhaust products would be distributed along the trajectory of the LV, with the greatest initial concentration at ground level due to the low initial velocity of the LV. This

concentration is called the launch cloud. The launch cloud would rise from the launch pad due to thermal buoyancy, move downwind, and disperse with time.

There are two principal areas of concern related to the effects of the launch cloud. First, the cloud constituents may have an effect on humans and plant and animal life downwind. The effects on humans will be considered in this section and effects on plant and animal life will be considered in the section on biological resources. Second, precipitation scavenging of a launch cloud by rain may produce localized acid rain which could adversely affect nearby land or water areas. Acid rain effects will be considered in the sections on water resources and biological resources. The primary constituent of concern in the launch cloud is HCl.

Table 10 Solid Rocket Motor Combustion Products

Combustion Product	Weight Fraction
AlCl	0.0003
AlClO	0.0001
$AlCl_2$	0.0002
$AlCl_3$	0.0001
Al_2O_3	0.3774
CO	0.2237
CO_2	0.0187
Cl	0.0028
HCl	0.2076
H	0.0002
OH	0.0002
H_2	0.0237
H_2O	0.0626
N_2	0.0824

$AlCl_x$	Aluminum chlorides
Cl	Atomic chlorine
H	Atomic hydrogen
OH	Hydroxide anion
H_2	Hydrogen molecule
N_2	Nitrogen molecule
Source:	USAF, 1988

Table 11 Main Vehicle Engine Combustion Products

Combustion Product	Weight Fraction
H	0.0015
H_2	0.0099
O	0.0059
O_2	0.0133
OH	0.0350
H_2O	0.2522
CO	0.4388
CO_2	0.2433

O Atomic oxygen

O_2 Oxygen molecule

Source: USAF, 1988

In the event of a catastrophic failure, conflagration and/or deflagration would occur. Conflagration is a failure mode in which there is burning of the solid propellants; deflagration is a failure mode in which there is burning of the hypergolic propellants. Although much of the solid and hypergolic propellants would be burned in either failure mode, emissions would include the constituents from a normal launch and dispersed propellants, including hydrazine. The health hazard qualities of these chemicals are summarized in Table 12 (ACGIH, 1995; 29 CFR 1910.1000; NIOSH, 1994; NRC, 1985a, NRC, 1985b; NRC, 1987).

For purposes of this analysis, the initial diameter of the launch cloud will be assumed as approximately 200 meters at ground level (NASA, 1973, USAF, 1994c). The area directly impacted by flame from the rocket exhaust is estimated to be approximately 80 meters in diameter (USAF, 1994c). The launch cloud rises rapidly and surface exposure to the cloud immediately after launch will be assumed to occur for approximately two minutes for this analysis. Surface exposure downwind of the launch complex will occur for longer periods at substantially lower concentrations. The above assumptions are based on a review of previous studies and conversations with personnel involved in the launch process. The studies are referenced below.

Table 12 Health Hazard Qualities of Hazardous Launch Emissions

Compound	EEGL	SPEGL	PEL	STEL	TLV	IDLH
Hydrazine (ppm)		0.12 for 1 hr 0.06 for 2 hr 0.03 for 4 hr 0.015 for 8 hr 0.008 for 16 hr 0.005 for 24 hr	0.1 (skin)		0.01 (skin)	50
Hydrochloric Acid or Hydrogen Chloride (ppm)	100 for 10 min 20 for 1 hr 20 for 24 hr	1 for 1 hour 1 for 1 day	5 (ceiling)		5 (ceiling)	50

EEGL Emergency Exposure Guidance Level - Advisory recommendations from the National Research Council for Department of Defense for an unpredicted single exposure.

SPEGL Short - term Public Emergency Guidance Level - Advisory recommendations from the National Research Council for Department of Defense for an unpredicted single exposure by sensitive population.

PEL Permissible Exposure Limit - Occupational Safety and Health Administration standards averaged over 8 - hour period, except for ceiling values which may not be exceeded in workplace.

STEL Short Term Exposure Limit - Occupational Safety and Health Admi nistration standards averaged over 15 - minute period in workplace.

TLV Threshold Limit Value - Recommendations of the American Conference of Governmental Industrial Hygienists.

IDLH Immediately Dangerous to Life or Health - Air concentration at which an unprotected worker can escape without debilitating injury or health effect.

Effluent sampling and model development regarding the characteristics of the launch cloud were performed in the 1970's for a Delta 1914 (a predecessor to the Delta II 7925) and several launches of Titan III LVs (APCA, 1983; NASA, 1973; NASA, 1974). This work was performed to quantify the potential effects of the Space Shuttle program. Additional work has been performed for the Space Shuttle program. The results of Space

Shuttle testing are not considered directly applicable to the Atlas IIAS LV because of the disproportionate amount of the solid rocket propellant (2,214,000 pounds of propellant).

The Delta LV launch occurred on November 9, 1972. Six Castor II solid rocket motors were used on this LV at liftoff, containing a total of 49,400 pounds of propellant. The launch cloud rose rapidly to a height of approximately 550 meters four minutes after launch and had a horizontal diameter of approximately 500 meters at that time (NASA, 1973). Model calculations predicted that the centroid of the launch cloud would stabilize at a height of 747 meters. At 202 seconds after launch, a sampling aircraft flew through the launch cloud at an altitude of 396 meters and recorded an HCl concentration of 10 parts per million (ppm) (NASA, 1974). Subsequent flythroughs at 310 seconds and 865 seconds at altitudes of 701 meters and 914 meters, respectively, recorded HCl concentrations less than 10 ppm and 0 ppm, respectively. Additional sampling runs at an altitude of 183 meters along the projected cloud path recorded no HCl. The study indicated that these results were qualitative and probably low.

Ground monitoring stations recorded levels of HCl downwind of the launch complex at concentrations below 2 ppm as far as five kilometers distant. Particulates increased by a factor of three over ambient conditions to a peak of approximately 190 micrograms per cubic meter at a station 3.18-kilometers downwind. Particulate levels increased by smaller quantities at other stations (NASA, 1974).

The two solid rocket motors on the Titan III LV contain a total of 926,000 pounds of propellant (AIAA, 1995). The launch clouds from eight Titan III launches were sampled by aircraft from 1974 to 1978. Typically, the aircraft would penetrate the launch clouds within two to four minutes after launch and fly in and out of the launch cloud over a prolonged period. For the three with the most comprehensive HCl data, the peak measured concentrations were approximately 30 ppm at the beginning of the data sets, with concentrations decreasing over time. The launch clouds for two of the launches stabilized at an altitude of approximately 1,200 meters (APCA, 1983).

The launch cloud from one of the Titan III launches encountered rain from a large convective storm approximately 20 to 30 minutes after launch. The HCl in the launch cloud was abruptly depleted and rain with a pH of less than 1.5 occurred over an area of approximately 7 square kilometers.

The Air Force uses the Rocket Exhaust Effluent Dispersion Model (REEDM) to determine the concentration and areal extent of launch cloud emissions from LVs. For the Atlas IIAS normal launch scenario, the maximum downrange concentration of HCl occurred at a distance of eight miles at a concentration of 0.8 ppm (USAF, 1991). For the catastrophic launch scenario, the maximum HCl concentration was 1.2 ppm. A series of model runs were performed and these concentrations represent the highest anticipated concentrations based on historic meteorological conditions (USAF, 1991).

Unprotected individuals within 100 meters of the launch pad during a normal launch would likely be killed or injured due to heat, high levels of HCl, and noise. Prior to launch, a clear zone will be established around the launch pad with all unprotected personnel removed from the area. The only personnel within the clear zone will be in the protected and sealed blockhouse at the launch complex. Additionally, a blast danger zone will be established. In the event of a catastrophic launch failure, no personnel will be in the blast area except those in the blockhouse, which has been designed to protect personnel in this circumstance.

HCl concentrations would not be hazardous except in the immediate vicinity of the launch pad for approximately two minutes after launch or near the centroid of the launch cloud for a short time after the launch. The launch cloud would be several hundred meters above ground level, depending on meteorological conditions. These hazardous concentrations near the centroid of the launch cloud would persist for an estimated 10 minutes, but could occur for shorter or longer periods depending on meteorological conditions. Airplanes are not allowed near the Cape Canaveral AS area during launches. Personnel are cleared from the areas where potentially hazardous concentrations would occur prior to launch, and there should be no hazard to humans associated with HCl from the rocket exhaust.

No model results for hydrazine concentrations associated with a catastrophic launch failure scenario were presented in the Atlas IIAS EA. Based on model results for the Delta II (USAF, 1994c), hazardous concentrations would not occur except in the immediate vicinity of the launch complex. Since personnel will be cleared from the area prior to launch, except for those in the sealed and protected blockhouse, there should be no hazard to humans from dispersed propellants in the event of a catastrophic launch failure.

No Action Alternative

Under the no action alternative, there would be no change in the baseline conditions described in Section 3.

4.2.2 Water Resources

An impact to water resources may be considered significant if the federal action interfered with drainage, exceeded the capacities of the regional supply systems, or resulted in degradation of surface water quality such that existing defined surface water uses would be impaired. Baseline information concerning Cape Canaveral AS water resources is in Section 3.3.2.

Proposed Action

Actions associated with LV processing and launch that could potentially affect water quality include the following:

- Discharge of deluge water to grade at the launch complex
- Propellant leaks on the launch pad or storage areas
- Spent suborbital stages (containing residual propellants) and jettisoned hardware from normal flights falling into the ocean
- Exhaust cloud deposition of hydrochloric acid and aluminum oxide in surface waters
- Catastrophic launch failure resulting in deposition of propellants in surface waters.

For each launch of an Atlas IIAS, approximately 745,000 gallons of deluge water would be directed at the surface of the launch pad. This water would be collected in a flume directly beneath the launch vehicle and routed to a lined catchment basin. Deluge water in the catchment basin will be tested to determine its hazard potential. If the deluge water meets state and Federal discharge criteria, it would be released to grade in accordance with an industrial wastewater discharge permit. If discharge criteria are not met, the water in the catchment basin would be neutralized before release to grade. If water quality is still unacceptable, the deluge water would be treated or disposed in accordance with applicable regulations governing the disposal of hazardous wastes. Deluge water from launch vehicles at Cape Canaveral AS has been acceptable for discharge to grade and has not been disposed of as hazardous waste.

Ground water recharge to the surface aquifer underlying Cape Canaveral AS would increase due to the percolation of the deluge water. The water would flow west toward the Banana River. Because deluge water would be released in accordance with an approved discharge permit, no adverse effects to the water quality of the unconfined aquifer or the Banana River would be expected from discharge of the deluge water. The unconfined aquifer is not used as a major water source at Cape Canaveral AS.

Propellant or oxidizer leaks at the launch pad or as a result of launch pad accidents will be prevented or controlled in accordance with 45 SW OPlans 19-1 and 32-3. All propellant tanks at the launch complex would be located within concrete containment structures designed to retain 110 percent of storage tank volumes. Accidental leaks of propellants during loading at the launch pad would be caught in catchment tubs on the propellant transfer equipment or in the launch pad catchment flume.

Spent stages and jettisoned hardware from normal flight operations will contribute various metal ions and small amounts of residual propellant and oxidizers to the ocean. Due to the slow rate of corrosion in deep ocean environments, toxic concentrations of metals are not likely to occur near the hardware. Trace amounts of weakly soluble RP-1 would form a local surface film that would evaporate within a few hours. Trace amounts

of soluble propellant would disperse rapidly in ocean waters. The solid rocket motors would contain trace amounts of ammonium perchlorate mixed in remnant HTPB binder. Ammonium perchlorate is moderately toxic and freely soluble in water, but would be released slowly to the ocean because of the binder.

The launch cloud for a LV is formed when exhaust products from the launch vehicle main engine and SRMs combine with the deluge water aimed at the exhaust stream. The launch cloud is comprised of concentrated effluents from the LV during the first few seconds after ignition when the LV is traveling at low velocity. Impacts on surface water quality from the launch vehicle exhaust cloud are a function of the composition of the exhaust cloud, duration of contact with the surface water, wind speed, wind direction, and other atmospheric conditions. The rapid ascent rate of a medium LV allows the exhaust from only the first few seconds to form the launch cloud. The cloud would persist at the launch complex for a few minutes after launch and then move downwind of the launch complex. The launch cloud would not remain over any single location for more than a few minutes. The launch cloud may encounter surface waters of the Banana River or the Atlantic Ocean depending on the wind direction (USAF, 1988).

The primary exhaust products of concern would be HCl and aluminum oxide from the SRMs. Studies of space shuttle exhaust (BC, 1991) show that short-term depression of surface water pH may result from direct contact with the exhaust cloud or through direct deposition of HCl as precipitation. The buffering capacity of nearby surface waters would tend to correct pH depressions within a relatively short time. Aluminum oxide is relatively insoluble at the pH of nearby surface waters, and it is unlikely that deposition will result in significantly elevated aluminum levels. Additionally, the high level of organic particulate matter in nearby surface waters is likely to aid in complexing much of the aluminum oxide that may be deposited.

In the event of a catastrophic failure, destruct mechanisms are initiated which rupture the propellant containers and cause explosive burning of the solid and liquid propellants. The primary combustion products of concern would be hydrochloric acid and aluminum oxide from the solid rocket motors, and unburned hydrazine and RP-1. Other primary combustion products would include water, carbon dioxide, and carbon monoxide, which would not negatively affect water quality.

The nature and scope of the effects from a destructive failure would vary with altitude. Within the initial few seconds after launch, destruction would affect the launch complex and its immediate vicinity, including surface waters. Because of the trajectory, later destruction would primarily affect marine waters. At higher altitudes, dispersion during the fall would increase the impact area, but lessen the concentration.

For a catastrophic failure, the main effects on water quality would relate to effects on the aquatic communities in surface water bodies. These effects are assessed in the section on biological resources.

Since no new facilities would be constructed, storm water permits from the Saint Johns River Water Management District would not be required. The launch complex would be covered under the Cape Canaveral AS storm water pollution prevention plan.

No Action Alternative

Under the no action alternative, there would be no change in the baseline conditions described in Section 3.

4.2.3 Solid Waste

Solid waste impacts may be considered significant if the federal action resulted in noncompliance with applicable regulatory guidelines or increased the quantities of solid waste generated beyond available waste management capacities. Baseline information concerning Cape Canaveral AS solid waste is in Section 3.3.4.

Proposed Action

The Atlas II AS LV program would generate approximately 2.5 tons of solid waste for up to four launches annually (Russo, 1996). Assuming none of this waste was recyclable, this amount would represent approximately 0.13 percent of the current solid waste disposed at the Brevard County Landfill from Cape Canaveral AS of 1,986 tons annually.

No Action Alternative

Under the no action alternative, there would be no change in the baseline conditions described in Section 3.

4.2.4 Hazardous Materials

Hazardous materials impacts may be considered significant if the federal action resulted in noncompliance with applicable regulatory guidelines. Baseline information concerning Cape Canaveral AS hazardous materials is in Section 3.3.5.

Proposed Action

None of the previous environmental assessments relative to Atlas LV processing at Cape Canaveral AS identified specific potentially hazardous materials that would be used, except for materials associated with processing of the solid rocket motors for the Atlas IIAS (USAF, 1989a; USAF, 1991). The following discussion is primarily drawn from the hazardous materials assessment for the Delta II LV (USAF, 1994c).

Hydrazine represents the most potentially dangerous hazardous material used during LV processing, and would have potential hazards associated with toxicity, reactivity, ignitability, and corrosivity. The JPC would deliver hydrazine to the propellant loading area in an approved container and would retrieve the empty container and the flush waste container when fueling activities were complete.

RP-1 and liquid oxygen would be required for the core vehicle propulsion system and would likely be stored at the launch complex. Loading of RP-1 and liquid oxygen is typically done by closed system to prevent release of vapors to the atmosphere. SRMs would be delivered to Cape Canaveral AS with the solid propellant in place.

Propellant and oxidizer loading activities for all stages shall comply with OSHA and AFOSH standards for safety and health to minimize the potential for hazards. With the exception of hydrazine air emissions at the PSF, no other impacts would be expected from the normal handling of propellants associated with the LV.

Solvents would be used in small quantities throughout LV processing for wipe cleaning and degreasing. On average, quantities used would be limited to less than one gallon of each solvent per month, although the specific quantity of solvent used at any one time would vary with the type of cleaning operation. Isopropyl alcohol would be the most commonly used solvent, and could be stored in an aboveground storage tank. Other solvents will be stored in small quantities at the area of use in approved flammable materials storage lockers. All solvents can be expected to release minor amounts of volatile constituents to the air in the immediate areas in which they are used. Solvents will be used in well-ventilated areas to prevent a buildup of hazardous vapors, and precautions will be taken to prevent exposure of vapors to ignition sources. Aside from minor air emissions, no other impacts are expected from the normal use of solvents during LV processing.

Coatings would be used during LV processing to provide corrosion control of various parts and launch equipment. Primary coating operations would be done in a permitted paint booth. Approximately two gallons of various enamels and primers would likely be used each month in this booth. The use of coatings will release volatile constituents to the atmosphere as part of the drying process. Impacts associated with coating emissions are presented in the section on air quality. No other impacts are expected from the normal use of coatings during LV processing.

Adhesives would be used in small amounts in all LV processing facilities as necessary for bonding LV components and general maintenance and repair. Perishable adhesives would be kept in refrigerated storage lockers. Nonperishable adhesives would be stored in approved flammable materials storage lockers at each facility. Quantities used would vary with the intended task, and supplies will be maintained as necessary. Adhesives will release small amounts of volatiles in the immediate area of use. Precautions will be taken

to prevent inhalation and fire hazards. Other than minor air emissions, no other impacts are expected from the normal use of adhesives during LV processing.

Compressed gases would be used for welding operations and as necessary for fuel line purging and miscellaneous processes requiring pressurized gases. All compressed gas cylinders will be stored in approved storage areas to minimize the potential for puncture and exposure to ignition sources. Quantities of compressed gases used would vary with the activity (e.g., number of welding operations), and supplies would be maintained on an as-needed basis. No adverse impacts are expected from the normal use of compressed gases during LV processing.

Oils and lubricants would be used as needed for general maintenance. Approved POL storage sheds will be maintained to store oils and lubricants. Quantities needed for processing would vary, and supplies would be ordered and maintained as necessary. The normal use of these materials during LV processing is not expected to present adverse impacts.

Corrosive materials would be used for metals cleaning and etching. A process tank line with bulk-quantity acid solutions would likely be used for metals etching and acid washes, potentially including hydrofluoric acid, nitric acid, chromic acid, phosphoric acid, and an alodine 1200 solution. Other corrosives would be used in small amounts at various processing facilities for miscellaneous cleaning and etching. Corrosives will be adequately contained in tanks or other structures (e.g., battery cases) to prevent release. Precautions will be taken, including the use of protective clothing, to minimize potential hazards associated with the toxicity and corrosivity of corrosive materials. No adverse impacts to human health or the environment are expected from the normal use of corrosives during LV processing.

Explosive ordnance used on both the satellite and the LV would present potential safety risks associated with accidental explosions. Safety hazards from accidental explosions are described in the section on health and safety.

EPA-17 industrial toxics used during LV processing would typically include methyl ethyl ketone, toluene, and xylene. Toluene and xylene are used as pure solvents and are also found in lacquer thinner and some coatings. All materials containing these constituents would be used in small amounts and stored in approved storage lockers when not in use.

The contractor for the LV would be encouraged to participate in the hazardous materials pharmacy at Patrick AFB as necessary for procurement of hazardous materials. Hazardous material spill prevention and control for satellite processing activities shall be in accordance with 45 SW OPlans 19-1 and 32-3.

No Action Alternative

Under the no action alternative, there would be no change in the baseline conditions described in Section 3.

4.2.5 Hazardous Waste

Impacts to hazardous waste management may be considered significant if the federal action resulted in noncompliance with applicable regulatory guidelines or increased the amounts generated beyond available waste management capacities. Baseline information concerning Cape Canaveral AS hazardous waste is in Section 3.3.6.

Proposed Action

Hazardous materials associated with typical LV processing can potentially generate hazardous waste. The contractor for the LV will be responsible for identification, containerization, labeling, and accumulation of hazardous wastes in accordance with all applicable federal, state, and local regulations, and with 45 SW OPlan 19-14. All hazardous wastes generated from LV activities will be transported, treated, stored, and disposed (or arrangements made for disposal) by the JPC.

The hazardous waste generation rate for up to four launches annually of the Atlas II AS at Cape Canaveral AS is approximately 16,000 pounds (Russo, 1996). This represents approximately 2.4 percent of the current hazardous waste transferred off-site from Cape Canaveral AS of 676,000 pounds annually.

No Action Alternative

Under the no action alternative, there would be no change in the baseline conditions described in Section 3.

4.2.6 Pollution Prevention

An impact on pollution prevention may be considered significant if the federal action affected the ability of the installation to achieve pollution prevention goals. Baseline information concerning Cape Canaveral AS pollution prevention is in Section 3.3.7.

Proposed Action

No Class I ODSs would be used. The air-conditioning systems would use Freon-22 refrigerant, a Class II ODS considered to be much less harmful than other Class I refrigerants due to its lower ozone-depleting potential. Small quantities of materials that contain EPA-17 targeted industrial toxics may be used during LV processing. These include coatings and thinners which typically contain toluene and xylene.

Toluene and xylene are also listed chemicals under EPCRA section 313. Although, toluene and xylene amounts for the launch operations are not anticipated to exceed the usage threshold of 10,000 pounds, each will contribute to the total amounts of toluene

and xylene used at the entire facility. If toluene or xylene usage at Cape Canaveral AS as a whole exceeds the reporting threshold, release pathways for each chemical in exceedance will have to be documented in the toxic release inventory Form R reports submitted to the EPA. Therefore, contractors at Cape Canaveral AS must track all EPCRA-listed chemicals and report emissions to 45 CES/CEV. A separate Form R report is required for each exceeding chemical. Since toluene and xylene are expected to be found exclusively in thinners and coatings at the PSTF, the entire quantity of each will be released to the air during usage of the materials and should be reported as a release.

The SBIRS LV program shall comply with the PPMAP being developed by Cape Canaveral AS. Compliance with the PPMAP will minimize pollution and meet the regulatory requirements relative to pollution prevention.

No Action Alternative

Under the no action alternative, there would be no change in the baseline conditions described in Section 3.

4.2.7 Nonionizing Radiation

Nonionizing radiation impacts may be considered significant if personnel would be exposed to levels of radiation in excess of the maximum permissible exposures recommended by the IEEE (IEEE, 1992). Baseline information concerning Cape Canaveral AS nonionizing radiation is in Section 3.3.8.

Proposed Action

The Atlas II launch vehicle uses S-band and C-band antennas which operate at approximately 2,000 Megahertz (MHz) and 6,000 MHz, respectively. The S-band antenna would be used for transmitting telemetry information and the C-band antenna will be used as a beacon transponder. These should be representative of the EELV LV. Based on previous analyses (USAF, 1994c), all antennas on the Atlas II launch vehicle would have safe distances of less than one foot. Due to this short distance, no impacts from these antennas are anticipated. Personnel shall remain outside the 1-foot safe distance during prelaunch activities.

All activities generating nonionizing radiation shall be coordinated with the base radiation office (45 ADMS/SGPH) and base safety (45 SW/SG) for compliance with Air Force, DoD, and federal regulations regarding radiation protection.

No Action Alternative

Under the no action alternative, there would be no change in the baseline conditions described in Section 3.

4.2.8 Water Supply

Impacts to the water supply system may be considered significant if the federal action substantially increased the demands on the utility systems resulting in the need for additional capacity or new facilities. Baseline information concerning Cape Canaveral AS water supply is in Section 3.3.9.

Proposed Action

The Cape Canaveral AS water supply system is designed to provide deluge water in large quantities as needed. For each launch of an Atlas IIAS, approximately 745,000 gallons of deluge water would be used. This is slightly more than one day of average usage at the installation.

No Action Alternative

Under the no action alternative, there would be no change in the baseline conditions described in Section 3.

4.2.9 Noise

An impact may be considered significant if the federal action increased substantially the ambient noise levels for adjoining areas with noise sensitive uses. Baseline information concerning Cape Canaveral AS noise is in Section 3.3.10.

Proposed Action

Noise sources in prelaunch processing areas typically include pumps and compressors. Fabrication, assembly, painting, and other related operational activities will be conducted inside buildings. These activities are typical for an industrial facility and similar activities occur at different locations on Cape Canaveral AS. All necessary and feasible noise control mitigation measures will be implemented at the affected facilities to meet worker noise exposure limits as specified by the Occupational Safety and Health Administration (OSHA). Due to the distances involved, there will be no noise impact at sensitive receptor locations in public residential areas as a result of the normal prelaunch processing operations.

The emitted acoustic power from a rocket and frequency spectrum of the noise are related to the size of the rocket engine, its thrust level, and the specific impulse which relates to the selected propellants. Rocket propulsion systems generate acoustic energy fields that encompass a wide frequency spectrum (1 Hertz to 100,000 Hertz). Normally, a large portion of the total acoustic energy is contained in the low frequency end of the spectrum. Sonic booms are also generated during the ascent of the vehicle and during reentry of spent suborbital and orbital stages.

Physically, sound pressure magnitude is measured and quantified using a logarithmic ratio of pressures whose scale gives the level of sound in decibels (dB). Because human

hearing is not equally sensitive to sound at all frequencies, a frequency-dependent adjustment called A-weighting has been devised to measure sound in a manner similar to the way the human hearing system responds. The A-weighted sound level is expressed in dBA.

When sound levels are measured at distinct intervals over a period of time, they indicate the statistical distribution of the overall level in a community during that period. The most common parameter associated with such measurements is the energy equivalent sound level (L_{eq}). L_{eq} is a single-number sound descriptor representing the average sound level in a real environment, where the actual sound level varies with time.

Several methods have been devised to relate noise exposure over time to community response. The EPA has developed the day-night average sound level (L_{dn}) as the rating method to describe long term annoyance from environmental noise. L_{dn} is similar to a 24-hour L_{eq} A-weighted sound level, except that during the nighttime period (10 P.M. to 7 A.M.) a 10 dBA weighted penalty is added to the instantaneous sound level before computing the 24-hour average. The Air Force uses L_{dn} for evaluating community noise impacts.

For evaluating community noise impacts, a time-weighted noise level of 70 dBA L_{eq} is recommended by the USEPA for the total general public as a noise exposure level that will not cause hearing damage (USEPA, 1974). The USEPA has also stated that noise levels higher than 55 dBA L_{dn} in a residential area can cause annoyance and communication interference during outdoor activities.

Specific measured data for noise levels associated with the Atlas IIAS is not available. Based on modeling results, the noise level during the launch of an Atlas II would be expected to reach a peak of 93 dBA at a distance of 3.1 miles from the launch site. The closest area outside of Cape Canaveral AS is approximately 5.2 miles south (USAF, 1989a). At this location, the noise level would be approximately 88.5 dBA. These levels would exceed ambient noise levels both day and night and exceed the EPA criterion for annoyance and communication interference. However, these noise levels will be for a very short time period, usually less than two minutes for the greater noise levels, and will occur approximately four time per year for the SBIRS program launches. Such levels would not cause any hearing damage to residents. From an annoyance standpoint, there could be residents in the area who would find this short duration noise objectionable. Because many residents of the cities of Cape Canaveral and Merritt Island are accustomed to the activities at Cape Canaveral AS, the likelihood of complaints would be low.

For evaluating structural damage and window breakage due to launch noise and on-pad or early flight explosions, measurements taken during the launch of a Titan IIID at Vandenberg AFB indicate that the acoustic energy is not enough to cause any structural

damage outside the 120 dB contour for a normal launch (USAF, 1975a). The projected 120 dB overall sound pressure level contour for a Delta II launch is expected to be at a radius of one-half mile from the launch complex (USAF, 1994c). It is not anticipated that the Atlas IIAS 120 dB sound pressure level would be substantially different. There are no known instances where an Atlas IIAS launch caused structural damage to existing buildings. Therefore, Atlas IIAS launches are not anticipated to cause any off-base structural damage.

OSHA regulations do not permit unprotected exposure to impulse or impact noise levels in excess of 140 dB and exposure to noise levels of 115 dBA averaged over 15 minutes. Because of the clear zone, which is 5,000 feet for an Atlas II launch vehicle, hearing protection for workers would not be required since they would not be exposed to noise at these levels.

Sonic booms associated with launch of an Atlas IIAS would occur approximately 25 nautical miles downrange over the Atlantic Ocean and would be directed upward and toward the front of the LV (USAF, 1989a). Flight maneuvers can cause a curved launch path which allows the sonic booms from different parts of the trajectory to arrive at the same point on the surface at the same time. This results in a focusing effect, amplifying the pressure levels associated with the sonic boom in the focused zone. Specific information concerning the focused sonic boom associated with the Atlas IIAS LV is not available. However, measurements were made for the fifth Space Shuttle launch in the focused zone for the Space Shuttle approximately 39 nautical miles east of Cape Canaveral AS. The maximum overpressure was 3.66 pounds per square foot (NASA, 1983). This is less than the overpressure levels that occur when a car door is shut with the windows raised (NASA, 1978). Overpressure levels of this magnitude could produce a startle response in exposed marine life, but no deleterious effects would be anticipated. Overpressure levels associated with reentry of spent stages would not be expected to exceed four pounds per square foot, and would likely be on the order of two to three pounds per square foot (NASA, 1978).

No Action Alternative

Under the no action alternative, there would be no change in the baseline conditions described in Section 3.

4.2.10 Cultural Resources

Impacts to cultural resources may be considered significant if the federal action resulted in disturbance or loss of values or data that qualify a site for listing in the NRHP; substantial disturbance or loss of data from newly discovered properties or features prior to their recordation, evaluation and possible treatment; or substantial changes to the natural environment or access to it such that the practice of traditional cultural or religious

activities would be restricted. For purposes of this EA, potentially eligible resources are given the same consideration as listed and eligible resources. Baseline information concerning Cape Canaveral AS cultural resources is in Section 3.3.11.

Proposed Action

Cultural resources impacts are site-specific. Full compliance with Section 106 of the National Historic Preservation Act during the EIAP for the EELV should limit the potential effects on cultural resources. Significant impacts are not anticipated.

No Action Alternative

Under the no action alternative, there would be no change in the baseline conditions described in Section 3.

4.2.11 Biological Resources

An impact to biological resources may be considered significant if the federal action would impact a threatened or endangered species, substantially diminish habitat for a plant or animal species, substantially diminish a regionally or locally important plant or animal species, interfere substantially with wildlife movement or reproductive behavior, and/or result in a substantial infusion of exotic plant or animal species. Baseline information concerning Cape Canaveral AS biological resources is in Section 3.3.12.

Proposed Action

Although potential effects of lighting associated with facilities at Cape Canaveral AS is a concern for endangered sea turtles, a lighting policy for management of exterior lights and emphasis on the use of low-pressure sodium lights has been implemented. Lights which emit ultraviolet, violet-blue, and blue-green wavelengths disorient sea turtle hatchlings on the beach. The disoriented hatchlings move inland rather than seaward and suffer increased mortality. The lighting at the EELV launch complex will conform to the lighting policy.

The eight launches for the SBIRS program would influence the local biological communities near the launch complex. Launch effects would primarily be associated with the launch cloud emitted at launch or catastrophic launch failure, and noise. Launch cloud constituents can directly affect biological communities through potentially hazardous concentrations and indirectly through precipitation scavenging of the HCl in the launch cloud, producing localized acid rain. The results of monitoring and modeling studies of launch vehicles are presented in the air quality section, along with predicted concentrations of potentially hazardous launch cloud constituents and their potential for harm to humans under normal and catastrophic launch scenarios.

Most of the combustion products from the LV would be released well above the ground surface and would not impact the local environment. The primary launch cloud

constituent of ecological concern produced during normal launch conditions is HCl. Under a catastrophic launch failure scenario, hydrazine would also be released into the local environment and is considered for potential ecological effects.

For purposes of this assessment, it will be assumed that the area directly impacted by flame from the rocket exhaust would be approximately 40 meters in radius (USAF, 1994c). High acidity from HCl in the rocket exhaust and burning of vegetation would occur in these areas. For purposes of this analysis, it is assumed that the initial radius of the launch cloud before it rises is approximately 100 meters at ground level (USAF, 1994c). These distances are approximations and meteorological conditions at launch will cause variance from these values. Typically, launch complexes at Cape Canaveral AS are surrounded by mowed areas to limit fire dangers.

After liftoff, the hot launch cloud rises rapidly to several hundred meters in height and stabilizes, with the height a function of meteorological conditions. The stabilized launch cloud moves downwind and disperses with time. Acute effects to biological communities from the launch cloud would occur in the immediate vicinity of the launch pad and downwind as the launch cloud constituents disperse to ground level.

For the proposed action, elevated noise levels would occur up to four times per year and last for two to four minutes. Noise exceeding 95 decibels A-weighted (dBA) has been found to cause hearing loss in fringe-toed lizards, desert kangaroo rats, and Couch's spadefoot toad (USAF, 1994c). After a June 1989 Titan IV launch, Florida scrub jays did not respond to alarm calls. However, after a space shuttle launch and a March 1990 Titan IV launch, the scrub jays did respond to alarm calls (USAF, 1990; USAF, 1991). For Titan IV launches, 95 dBA levels of noise or higher are experienced up to 15 miles from the launch pad. For Atlas IIAS launches, the 95 dBA radius is approximately three miles (USAF, 1991).

Vegetation. Unpaved areas within the launch complex would be grassed and mowed on a regular basis, at least two weeks prior to each launch. There would be no trees or scrub inside the security road of the complex. Depending on meteorological conditions, grass up to 40 meters from the launch pad may be scorched by the rocket exhaust (USAF, 1994c).

A catastrophic launch failure would likely increase the burned area beyond that anticipated with a normal launch, but acute vegetation impacts would not be expected to extend beyond the area of the launch complex.

The maximum REEDM launch cloud HCl concentrations at ground level for the normal Atlas IIAS launch scenario would be 0.8 ppm at 8 miles and 1.2 ppm for the catastrophic launch scenario (USAF, 1991). Hydrogen chloride gas is readily retained by moist surfaces, and is known to injure sensitive plant species at concentrations above 5

ppm in 60-minute or longer exposures. The response of plants to shorter exposure times or multiple exposures is not known (NASA, 1980).

The relative sensitivity of 36 plant species has been investigated (NASA, 1980). No adverse effects from gaseous HCl in the launch cloud to plant communities are anticipated because of the low predicted concentrations and a low time of exposure (less than 10 minutes).

Most foliar damage from LV launch clouds results from deposition of acid aerosol on leaf surfaces and not from gaseous HCl (NASA, 1985). If the launch cloud passes through the rainshaft of a storm cloud, the HCl in the launch cloud would be absorbed by raindrops, lowering the pH of the rain, and the acid raindrops would fall on vegetation and soil. Such an event would be rare, but has occurred for a Titan III launch (APCA, 1983). Similarly, if moisture is present on the foliage of vegetation in the path of the launch cloud, HCl would be absorbed by the moisture and can cause foliar injury.

Foliar damage to sensitive species could occur. However, this would be an infrequent event and the affected vegetation would be expected to recover, based on deposition impacts on vegetation from Space Shuttle launches (AIAA, 1993). Because soils at Cape Canaveral AS are well buffered by carbonates, adverse effects to soils are not anticipated. Moisture on vegetation foliage that is in the path of the launch cloud would absorb HCl from the cloud and the resultant acidification of the moisture could affect foliage. However, the predicted concentration of HCl in the launch cloud is sufficiently low that no damage is anticipated (NASA, 1980).

Al_2O_3 that may be deposited on vegetation would not be harmful (NASA, 1980). Hydrazine has been found to be mutagenic in higher plants; 43 percent of Vicia faba exposed to 50 ppm in liquid applied at the root showed mutagenic effects (HSDB, 1994).

Insects. Insects in the immediate vicinity of the launch pad will be killed at launch, primarily due to flame and heat. The radius of impact is anticipated to be no more than 40 meters. In the event of a catastrophic launch failure, the area of adverse effect should be confined to the launch complex area.

Three insect species were tested for susceptibility to HCl at various concentrations and durations (NASA, 1980). These insects were the honey bee, corn earworm, and lacewing. At the concentrations predicted by REEDM, there should be no adverse effects on these species. Specific toxicity information on the effects of dispersed hydrazine or aluminum oxide on insects is not available.

Terrestrial Wildlife. Based on environmental monitoring conducted for Space Shuttle operations (AIAA, 1993) and appropriate scaling for a medium launch vehicle such as the Atlas IIAS, it is anticipated that wildlife within 40 meters of the launch pad would be killed or injured during a normal launch by heat, debris, and noise. Up to 100

meters from the launch pad, it is anticipated that wildlife could experience some irritation from HCl concentrations in the launch cloud. In the event of a catastrophic failure, the impact area is anticipated to include the entire launch complex.

The launch complex would be surrounded by a security fence and personnel would be present. The herbaceous vegetation within the complex and frequent mowing would create a habitat with low value to wildlife. Significant populations of wildlife would not be present within the launch complex.

Toxicity data is available for selected test species. Rabbits and pigeons exposed to 100 ppm HCl for 6 hours daily for 50 days showed slight unrest and irritation of the eyes and nose and a slightly diminished hemoglobin content of blood (HSDB, 1994). An LC_{50} (the concentration of a constituent at which 50 percent mortality of test animals occurs) of 1,322 ppm HCl has been reported for unspecified mice exposed for 60 minutes (USEPA, 1994). An LC_{50} of 2,350 ppm HCl has been reported for unspecified rats exposed for 60 minutes (USEPA, 1994). An LC_{50} of 40,989 and 13,747 ppm, respectively, for rats and mice exposed for five minutes has also been reported (NRC, 1987). Numerous other studies for various test species had similar results (NRC, 1987). The concentrations are several orders of magnitude higher than the maximum HCl concentration contained in the launch cloud at ground level under any of the modeled launch scenarios.

Hydrazine is acutely toxic, a teratogen (causes developmental malformations), a neurotoxin (affects the nervous system), a carcinogen (causes cancer), and a mutagen (causes genetic mutation). Although toxicity information is not available for the specific species found at Cape Canaveral AS, test species including rats, mice, dogs, and monkeys have been extensively studied with regard to the effects of hydrazine (NRC, 1985b). Hydrazine produces acute effects at higher concentrations and has been shown to be carcinogenic in the mouse and the rat. Dogs exposed to 4-5 ppm of hydrazine vapor for six hours per day showed liver damage after one week. An inhalation LC_{50} of 570 ppm for four hours with sense organ effects, convulsion, and seizures has been reported for unspecified rats (RTECS, 1994). An inhalation LC_{50} of 252 ppm for four hours with sense organ effects, convulsion, and seizures has been also been reported for unspecified mice (RTECS, 1994). The recommendations by the National Research Council regarding short duration exposure concentrations for hydrazine (section on air quality) are based on these animal studies, in particular on the potential carcinogenicity of hydrazine. In the event of a catastrophic launch failure, wildlife within the launch complex would likely be killed or injured. The anticipated downwind concentrations and duration of exposure by wildlife to hydrazine would not be expected to adversely affect wildlife (USAF, 1994c).

Aquatic Communities. HCl would affect aquatic communities by lowering the pH of the water. Depression of pH affects organisms utilizing gills for respiration. Fish kills

resulting from acidification of shallow surface waters by deposition of HCl in the launch cloud have been observed following some shuttle launches (AIAA, 1993). Acidification was found to correspond with areas directly impacted by the launch cloud deposition and deluge water runoff from the launch pad. The acid mixes down the water column and the rate of mixing is driven by windspeed and direction. Levels of impact would be variable and depend on meteorological conditions at the time of launch. Minimal effects were observed around the edges of the launch cloud and below shallow surface depths where buffering and dilution minimize effects. Only shallow waters near a launch complex would have the potential for fish kills since fish are able to avoid surface depression of pH if the water column is sufficiently deep (AIAA, 1993). The combination of events required to create such potential would occur rarely.

Aluminum oxide would not affect aquatic communities because the oxides are relatively insoluble at ambient pH values (USAF, 1991). Test aquatic species exposed to hydrazine include goldfish and daphnia pulex. The median lethal concentrations for a 24-hour period are 3.2 mg/L and 1.7 mg/L, respectively (USAF, 1975b). The recommended maximum acceptable concentration (MAC) is 0.7 mg/L (NASA, 1978). If the total amount of hydrazine carried on the LV were deposited in a water body, a cube of water with dimensions of 51.4 meters on each side would be required to reduce the concentrations to the MAC.

The recommended MAC for RP-1 fuel (kerosene) based on exposure of trout to gasoline is 40 mg/L (NASA, 1978). RP-1 fuel that entered a water body would not dissolve in the water (except for a small fraction), but would spread out in a surface film. This film could inhibit the ability of oxygen to penetrate into the water body and replenish oxygen used by aquatic organisms. In large water bodies, the film would dissipate within a matter of hours (USAF, 1988). In small water bodies, the film would adversely affect the aquatic community.

Large water bodies would be locally affected near the point of entry of these propellants up to a radius where dilution reduced the concentrations to nonhazardous levels. Small water bodies would be adversely affected by the deposition of these amounts of propellants. The destruct systems on the LVs are designed to cause combustion of the fuel, whether liquid or solid. The only circumstance where substantial quantities of propellant would be expected to enter water bodies would be a failure of one of the operational subsystems of the LV combined with a failure of the destruct subsystem.

Hydrazine in the launch cloud from a catastrophic failure would dissolve into water bodies that came into contact with the launch cloud. Given the nonhazardous concentrations in the air, the short time (minutes) during which a water body would be exposed to the launch cloud, and the limited area of the launch cloud where solution

would occur at the water surface, the hydrazine dispersed in the launch cloud from a catastrophic failure would not be anticipated to adversely affect aquatic communities.

Threatened and Endangered Species. Species that are given special protection or consideration by the USFWS and the FGFWFC may potentially occur within vegetative communities near the EELV launch complex. These species are listed in Section 3. Once the launch complex had been placed in service, direct effects to these species at the launch complex would be unlikely due to unsuitable habitat or ongoing disturbance. Sea turtle hatchlings would be affected by the activation of a previously closed launch complex and consultation under Section 7 of the Endangered Species Act shall be conducted for the EELV program. The EIAP for the EELV will assess site-specific impacts prior to the launch of SBIRS satellites.

Potential acute impacts to protected species could result from gaseous HCl produced under normal and catastrophic failure launch scenarios, and hydrazine dispersed under a catastrophic launch failure scenario. No toxicity data is available for any of these species. As discussed in the previous paragraphs, concentrations and durations of exposure to these constituents are not anticipated to adversely affect wildlife.

No Action Alternative

Under the no action alternative, there would be no change in the baseline conditions described in Section 3.

4.2.12 Health and Safety

An impact may be considered significant if it would create a public health hazard. Baseline information concerning Cape Canaveral AS health and safety is in Section 3.3.13.

Proposed Action

In addition to the general safety regulations and standards enumerated in Section 3, LV processing safety will be addressed in the Missile System Prelaunch Safety Package for the EELV LV and safety plans for all hazardous processes. Safety concerns regarding LV processing operations can generally be divided into injury to personnel and damage to property.

Possible impact to health and safety include injuries and/or property damage. These impacts may arise from accidents involving transport vehicles delivering or manipulating system components. Additionally, contact of employees with electrically charged components, exposure to hazardous levels of radio frequency radiation or materials, failure of pressurized components, etc. may cause injuries as would normal workplace hazards. Injuries from catastrophic system malfunctions or reentry of system components are highly improbable (Aerospace, 1992).

Mishaps during air transport of LV components are unlikely since flight crews are constantly trained in operation and safety of the aircraft. Ground transport accidents are also unlikely because of the low speeds, precautions, and times when transport occurs.

At launch complexes, clear zones are used at different stages of prelaunch preparation and during launch to protect personnel against catastrophic events. During hazardous operations, special clear zones are established. A blast danger zone and a launch danger area are established and maintained minutes prior to launch. Areas offshore from Cape Canaveral AS are cleared prior to launch.

Orbital reentry of all components of the LV will occur within an estimated four years. The SRMs and the core vehicle will fall into the ocean. All remaining propellants in the Centaur II upper stage will be burned, and reentry will normally occur within four years.

Before launch, the SRM drop zone off Cape Canaveral AS is cleared of all shipping. The SRMs typically break in half before impact. The core vehicle would be destroyed on reentry.

Two primary factors determine whether or not an object will survive reentry and strike the Earth: the melting point of its material and its ballistic coefficient. The ballistic coefficient is the mass of an object compared to its area. As an object reenters, friction with the atmosphere produces heat. Heating begins at approximately 80 nautical miles and the heating rate peaks at 30 to 45 nautical miles, depending on the ballistic coefficient of the object. The integrity of an object is maintained until its melting temperature is reached, and the ballistic coefficient of the object determines the maximum temperature that will be reached during reentry (Aerospace, 1992).

Space and launch vehicles with an aluminum structure typically breakup at 42 nautical miles. The subsidiary objects resulting from this breakup will then be exposed to atmospheric drag, and their fate will vary depending on their material and ballistic coefficient. Aluminum objects with a ballistic coefficient of less than 15 pounds per square feet will generally survive. Propellant and pressurant tanks made from titanium will generally survive reentry intact, regardless of ballistic coefficient, because of titanium's high melting temperature (Aerospace, 1992).

Therefore, certain components of the LV may survive reentry. For those objects with a high ballistic coefficient that survive reentry, the results of a person being struck, whether in a building or not, would probably be fatal. Those objects with a lower ballistic coefficient would probably produce injury or death. To date there have been no injuries or fatalities from reentering objects. Over the period 1958 to 1991, NASA indicated that 14,831 payloads and debris objects reentered the atmosphere (NASA, 1991). The daily average individual risk from reentering objects computed by the Aerospace Corporation is

substantially smaller than such hazards as work accidents, lightning, air carrier accidents, or smallpox vaccinations, and is comparable to that of being struck by a meteorite (meteor that survives to Earth impact). The only reported incident of a meteorite striking a person occurred in 1954 when a woman was bruised by a stone meteorite that crashed through the roof of her house (Aerospace, 1992). Assuming an increase in the number of reentering objects would increase the risk on a proportional basis, a 100-fold increase in objects with a consequent 100-fold increase in risk would produce a daily average individual risk still substantially less than any of the hazards mentioned previously.

The safety concerns listed in previous sections would all be considered in planning for prelaunch processing and launch. Detailed procedures and training for all hazardous processes have been or are being prepared and implemented. Launch constraints based on wind speed and direction are in effect, with lower wind speed required for southerly and southeasterly winds. The 45th Space Wing Director of Safety will review and approve all safety procedures.

Additional precautions are taken to ensure that the risk from lightning strikes is reduced. All facilities on Cape Canaveral AS incorporate lightning arresting devices for protection against lightning strikes.

No Action Alternative

Under the no action alternative, there would be no change in the baseline conditions described in Section 3.

4.2.13 Stratospheric Ozone

Based on criteria used by USEPA for risk assessment (USEPA, 1990), impacts to stratospheric ozone may be considered significant if the ozone destruction related to the federal activity caused one excess cancer per one million persons. Baseline information concerning stratospheric ozone is in Section 3.5.

Proposed Action

The phases of launch operations that could affect stratospheric O_3 are: facility operations, tropospheric emissions from the launch vehicle, stratospheric emissions from the launch vehicle, and deposition of materials and gases from the launch vehicle and/or satellite during reentry.

Since the time scale for mixing in the troposphere is less than the life cycle (decades) of most ODSs, these compounds are usually well mixed in the lower atmosphere. They eventually cycle between the troposphere and stratosphere where the compounds are dissociated by UV radiation in the stratosphere and react with O_3. Since no Class I ODSs will be used under the proposed or alternative action, ground facility operations are not anticipated to affect stratospheric ozone.

Launch emissions emitted in the troposphere would not affect stratospheric ozone because the inorganic chlorine and aluminum oxide (Al_2O_3) that could affect ozone are water soluble or rapidly react in the troposphere to form water soluble products or particles. These emissions would then be washed out of the atmosphere by rain in a time much shorter than the transport time to the stratosphere (Aerospace, 1994).

Constituents of the launch vehicle emissions that can potentially affect stratospheric ozone include HCl (through chlorine catalytic reaction cycles), nitrogen (N_2), and Al_2O_3. Nitrogen oxides (NO_x) rather than nitrogen are actually the constituents of concern for stratospheric ozone depletion. The four SRMs would produce a total of 10.7 tons of HCl (USAF, 1991), 4.2 tons of N_2 (calculated based on weight fractions from USAF, 1994c), and 19.4 tons of Al_2O_3 (USAF, 1991) from ignition to burn-out of the last two SRMs at an altitude of 105 km. Each launch of an Atlas IIAS emits three tons of inorganic chlorine and five tons of alumina directly to the stratosphere (Aerospace, 1994) at altitudes of 15 to 60 km. Assuming the N_2 was emitted at a constant rate over the 105 km flight path yields a stratospheric emission of two tons of N_2 per launch.

Recent studies have concluded that the potential for ozone depletion by NO_x in the stratosphere from rocket launches is negligible (TRW, 1996; Aerospace, 1995; Jackman, 1996). Potential stratospheric ozone depletion by NO_x from rocket launches will not be considered further in this assessment. Al_2O_3 could increase the rate of O_3 depletion through heterogeneous chemical reactions, but would not react directly with O_3. The potential changes in reaction rates that would be induced by Al_2O_3 are not known.

The average global stratospheric ozone depletion rates for chlorine have been previously calculated as a percent O_3 reduction per ton of exhaust emissions (USAF, 1989c). The relevant annual depletion rate was 2.5×10^{-5} percent reduction for each ton of Cl emitted. For the annual launch of 4 Atlas IIAS LVs, a total of 12 tons of chlorine would be emitted in the stratosphere, and the consequent global reduction in stratospheric ozone is estimated as 3.0×10^{-4} percent. It should be noted that a maximum of four launches in a single year is projected for the proposed action, not an annual launch rate of four.

A recent study evaluated the potential effects of the launch of nine Space Shuttles and three Titan IV LVs annually on stratospheric ozone (Jackman et al, 1996). This study was based on a model that considered chlorine catalytic reactions and heterogeneous reactions associated with the stratospheric sulfate aerosol layer and polar stratospheric clouds. For the annual emission of 799 tons of chlorine to the atmosphere associated with these launch rates, a reduction of 0.014 percent in stratospheric ozone was predicted. The percent reduction in ozone for each ton of chlorine emitted would be 1.75×10^{-5}, which compares to the 2.5×10^{-5} percent reduction used in this environmental assessment.

Since the actual configuration of the LV that would be used is not known and the range of potential impacts is large, additional analysis will be performed to "envelope" the potential impacts of a LV propelled entirely by SRMs (highest impact) and the potential impacts of a LV propelled entirely by liquid fuels (lowest impact). The solid-fuel LV will be assumed as two Space Shuttle SRMs strapped to a main vehicle comprised of a third Space Shuttle SRM. The liquid-fuel LV will be assumed to be substantially similar to the Russian Energia. Extrapolating from a recent analysis (Aerospace, 1994), each launch of the solid-fuel LV would deposit approximately 119 tons of Cl into the stratosphere. The consequent global reduction in ozone from four launches annually would be 1.2×10^{-2} percent. The liquid-fuel LV would emit no chlorine and negligible quantities of N_2 (primarily from afterburning) as documented in recent studies (Aerospace, 1995; Brady, 1996). Therefore, the liquid-fuel LV would not measurably affect stratospheric ozone levels.

Recent work evaluating the impacts of deorbiting debris on stratospheric O_3 considering homogeneous and heterogeneous reactions has been conducted (TRW, 1994). It was estimated that each of the two mechanisms for reentering space debris would produce total reductions in ozone of 0.0001 percent, considering all reentering space debris.

In addition to global reductions in O_3, it has been suggested by researchers that significant local ozone depletion is possible due to reactions of Cl contained in the HCl. Measurements have shown a reduction in local O_3 of greater than 40 percent below background in the exhaust path of a Titan III solid rocket 13 minutes after launch and at an altitude of 18 km. Also, calculations have indicated that a significant reduction of ozone would be expected within the plume of a rocket, with a return to 90 percent of the undisturbed value less than an hour after launch (Denison et al, 1994). Studies on the impact of space launch operations on local O_3 depletion are continuing, but these effects would be localized and temporary and are not anticipated to affect human health or the environment.

On a global level, consensus is that continuing destruction of stratospheric O_3 will lead to increased UV-B radiation resulting in potential damage to human health and the environment. The risks from O_3 depletion include increases in skin cancer and cataracts, suppression of the human immune response system, damage to crops and aquatic organisms, increased formation of ground-level smog, and accelerated weathering of outdoor plastics. Recent scientific reports state that O_3 depletion over Antarctica appears to be the direct result of increased concentrations of man-made chlorinated and brominated compounds, that the potential exists for significant O_3 depletion in the Arctic, and that O_3 concentrations in the mid-latitudes have been reduced over the last decade (WMO, 1989; WMO, 1991; WMO, 1995).

Estimating changes in these areas of concern from stratospheric ozone depletion is difficult due to uncertainties in estimating baseline ozone depletion, translating these depletions to the increased incidence of UV-B radiation at the surface of the Earth, and a lack of understanding of the various human and environmental dose/response mechanisms. For most of these effects, uncertainties are such that the impacts from the proposed action cannot be numerically estimated.

A major effort over the last several decades has been to understand the results of human epidemiological studies that have investigated the relationship between various forms of skin cancer and increased UV-B radiation. The USEPA has used the results of these studies to support its rulemaking on the protection of stratospheric ozone, concluding that it may be reasonably anticipated that an increase in UV-B radiation caused by a decrease in the ozone column would result in increased incidences of cutaneous malignant melanomas (potentially mortal skin cancers). In addition to the conclusions reached by USEPA, other analyses have been published which acknowledge the adverse relationship between reduced stratospheric ozone and increased cancer incidences (Shea, 1988; Van Der Leun, 1986). More recent work (UNEP, 1991; UNEP, 1994; Tevini, 1993) has presented the results of additional analyses that permit quantitative estimates for some of the effects. Generally, an increased risk level for cancer of one in 10,000 to one in a million is considered acceptable by USEPA with regard to carcinogens (USEPA, 1990).

Potential human health effects on the eyes include increased incidence of "snowblindness" and cataracts. The medical term for snowblindness is photokeratitis, an acute inflammation of the superficial layers of the eyes. The effect is dose related and can cause lasting damage in severe cases. Increased UV radiation will likely increase incidences. However, eye protection is available and a single incident is usually sufficient to encourage use of protective sunglasses (UNEP, 1994; Tevini, 1993).

Sufficient information is available with regard to cataracts to roughly forecast increases. An approximate 0.5 percent increase in cataracts would occur for each one percent drop in stratospheric ozone (UNEP, 1994; Tevini, 1993). An estimated 17 million people in the world are blind due to cataracts (Tevini, 1993). Based on calculations presented in the cited reference (Tevini, 1993), the number of additional blindness annually due to cataracts is estimated as 680,000. The ozone reduction associated with four annual Atlas IIAS launches would total 3.0×10^{-4} percent, producing an additional blind person worldwide annually. With an estimated world population of 6 billion, an additional 1 person would become blind for approximately every six billion people. For the four launches of the solid-fuel LV annually, ozone reduction would total 1.2×10^{-2} percent, producing an additional 40 blind people worldwide annually. With an

estimated world population of 6 billion, an additional person would become blind for approximately every 150 million people.

Increased ultraviolet radiation could also affect the human immune system, and the development of non-melanoma and melanoma skin cancers. UV-B radiation is generally suppressive of the immune system. A reduction in the efficiency of the immune system could lead to increases in infectious disease. The complexity of the immune system, which is comprised of several subsystems that help and suppress each other, and the complex reactions of different types of diseases to UV-radiation prevent any quantitative predictions of the effects of increased UV-B radiation given the current state of scientific knowledge (UNEP, 1994; Tevini, 1993).

Non-melanoma skin cancers mainly include basal cell carcinoma and squamous cell carcinoma. The mortality rate from non-melanoma skin cancer is less than or equal to one percent in areas with good medical care (UNEP, 1994; Tevini, 1993). An estimated 1.2 million cases occur worldwide annually (UNEP, 1994). The development of non-melanoma skin cancer is correlated strongly to exposure to sunlight and sufficient scientific information is available to roughly forecast the effects of increase UV-B radiation. A one percent decrease in stratospheric ozone is estimated to cause an increase of approximately 2.3 percent in non-melanoma skin cancer (UNEP, 1994; Tevini, 1993). The ozone reduction associated with four annual Atlas IIAS launches would total 3.0×10^{-4} percent, producing an additional 8 non-melanoma skin cancers worldwide annually. With an estimated world population of 6 billion, an additional 1 person would develop non-melanoma skin cancer for approximately every 750 million people. For the four launches of the solid-fuel LV annually, ozone reduction would total 1.2×10^{-2} percent, producing an additional 331 non-melanoma skin cancers worldwide annually. An additional 1 non-melanoma skin cancer would be produced for approximately every 18 million people worldwide.

For melanoma skin cancer, sufficient scientific information is not available to project increased incidences. The incidence of melanoma skin cancer is lower than non-melanoma skin cancer by a factor of ten (Tevini, 1993) for an estimated 120,000 cases worldwide annually. However, the mortality is much higher, approximately 25 percent in areas with good medical care (Tevini, 1993). Rather than cumulative exposure to UV-B radiation, studies suggest that melanoma may be produced by severe episodic exposures (sunburn). These results are inconclusive. Earlier estimates by USEPA (1987) were that each one percent decrease in stratospheric ozone would increase the incidence of melanomas by one to two percent and mortality by 0.8 to 1.5 percent. Because of the many uncertainties involved, these estimates are considered questionable (Tevini, 1993). Assuming each one percent decrease in stratospheric ozone would produce a two percent increase in melanoma incidence, the annual launch of four Atlas IIAS LVs would cause

one additional melanoma worldwide, or one in six billion. Stratospheric ozone depletion associated with the solid-fuel LV would cause 29 additional melanomas worldwide, or one for each 200 million people.

Two other major concerns exist with regard to depletion of stratospheric ozone. These include effects on aquatic ecosystems, in particular, effects on marine phytoplankton and larvae of higher organisms, and damage to crops.

Approximately 30 percent of the world's animal protein for human consumption comes from the sea (Tevini, 1983). The base of the marine food chain are the phytoplankton organisms which are concentrated in high latitudes where reductions in stratospheric ozone are predicted to cause the greatest increase in the amount of UV-B radiation reaching the Earth's surface. Equatorial regions contain densities of phytoplankton approximately 10 to 100 times smaller than the circumpolar regions (UNEP, 1994). Additional concentrations of phytoplankton occur in upwelling areas along the continental shelves. Investigations in Antarctica indicate that current UV-B radiation levels already affect phytoplankton productivity (UNEP, 1994; Tevini, 1993). Current UV-B radiation levels are also limiting factors for early developmental stages of fish, shrimp, crab, amphibians, and other animals (UNEP, 1994).

Quantitative estimates of the potential effects of increased UV-B radiation on the marine ecosystem are questionable given the current state of knowledge. A complicating factor is that small changes could cause nonlinear (multiplicative) reactions. One study estimated that a 16 percent reduction in stratospheric ozone levels would produce a five percent loss of phytoplankton productivity, leading to a loss of approximately seven million tons of fish from the annual fisheries harvest (UNEP, 1994).

Terrestrial plants vary considerably in their response to UV-B radiation between species and even between cultivars of the same species. Plants have several mechanisms to ameliorate or repair adverse effects from UV-B radiation, and may acclimate to a certain extent to increased UV-B radiation levels. In agriculture, reduction in stratospheric ozone will require the use of UV-B tolerant cultivars and the development of new ones. Scientific evidence indicates that there will be an adverse effect on crops, but the magnitude of these effects cannot be estimated given the current state of knowledge (UNEP, 1994; Tevini, 1993).

One last concern relates to the global warming potential associated with decreases in stratospheric ozone. Recent modeling studies conclude that decreases in stratospheric ozone serve to cool the global climate (WMO, 1994). Insufficient information is available to quantify the effects of rocket launches. However, the cooling effect is more than offset by other heating mechanisms that result from human activities.

Further research needs to be done on launch activities as sources of stratospheric ozone depleters. Not enough is known about the reactions, chemistry, and mixing of rocket emissions. Rocket plume ozone depletion potential needs to be better characterized. Heterogeneous mechanisms and reaction rates need to be tested in the lab, and findings then need to be included in the models. Actual measurement data is needed to verify and refine the predictive models. The Air Force and other agencies are funding research into all of these areas.

Additional research on the effects of increased UV-B levels on melanoma skin cancer and the human immune system is needed to determine dose/response relationships. Further research relative to the effects on aquatic and terrestrial ecosystems is also needed.

Table 13 Stratospheric Ozone Summary of Impacts

Type of Effect	Atlas IIAS	Liquid-Fuel LV	Solid-Fuel LV	Cumulative LVs
Photokeratitis	Non- quantifiable slight increased incidence; eye protection readily available.	No effect.	Non- quantifiable slight increased incidence; eye protection readily available.	Non- quantifiable slight increased incidence; eye protection readily available.
Cataract Blindness	Additional one blind person annually in world.	No effect.	Additional 40 blind people annually in world.	Additional 126 blind people annually in world.
Human Immune System	Unknown.	No effect.	Unknown.	Unknown.
Non- melanoma Skin Cancer	Additional eight cases annually in world.	No effect.	Additional 331 cases annually in world.	Additional 1,021 cases annually in world.
Melanoma Skin Cancer	Speculative estimate of additional one case annually in world.	No effect.	Speculative estimate of additional 29 cases annually in world.	Speculative estimate of additional 89 cases annually in world.
Aquatic Ecosystem	Non- quantifiable adverse effect, current UV- B radiation levels affect phytoplankton productivity and developmental stages of some aquatic organisms.	No effect.	Non- quantifiable adverse effect, current UV- B radiation levels affect phytoplankton productivity and developmental stages of some aquatic organisms.	Non- quantifiable adverse effect, current UV- B radiation levels affect phytoplankton productivity and developmental stages of some aquatic organisms.

Terrestrial Plants	Non- quantifiable adverse effect, response to increased UV- B differs between plants.	No effect.	Non- quantifiable adverse effect, response to increased UV- B differs between plants.	Non- quantifiable adverse effect, response to increased UV- B differs between plants.
Global Warming	Slight cooling.	No effect.	Slight cooling.	Slight cooling.

No Action Alternative

Under the no action alternative, there would be no change in the baseline conditions described in Section 3.

4.2.14 Cumulative Impacts

Cumulative effects result from the incremental effect of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time. Since the no action alternative does not involve any specific change from baseline conditions, no cumulative effects would occur for this alternative.

The various proposed ground facilities would entail impacts similar to past actions with insignificant impacts and would be situated in installations with existing facilities that are similar in nature. No significant cumulative impacts would be anticipated.

Launches for the SBIRS high component would occur at Cape Canaveral AS. Section 4.1.11 assessed the cumulative impacts at Cape Canaveral AS for both satellite and LV processing. No significant impacts at Cape Canaveral AS associated with the SBIRS program are anticipated. However, additional analysis is necessary regarding the cumulative impacts of LVs on stratospheric ozone.

Figure 6 shows stratospheric loading of Cl and Al_2O_3 for launch vehicles used by various countries with space programs (Aerospace, 1994). Figures 7 and 8 show stratospheric loading of Cl and alumina from worldwide launch activities (Aerospace, 1994). Assuming an annual chlorine deposition rate of 1,500 tons for the period 1998 to 2010, and a reduction in global ozone of 2.5×10^{-5} percent for each ton of Cl, ozone depletion due to launch activities would be 3.7×10^{-2} percent. As indicated in the stratospheric ozone impact section, rough estimates of increases in cataract blindness and non-melanoma skin cancer are possible, and speculative estimates of increases in melanoma skin cancer can be made. This level of ozone depletion would be expected to produce an additional 126 cataract blindnesses, 1,021 additional cases of non-melanoma skin cancer, and 89 additional cases of melanoma annually. These would represent additional instances of one per 50 million, one per 6 million, and one per 70 million worldwide, respectively. The most important contributors of chlorine during that time

period are the Space Shuttle, Titan IV, and Ariane V LVs. The deployment of new LVs designed to reduce chlorine deposition to the stratosphere could substantially reduce the forecast ozone depletion from LVs.

Significant cumulative impacts on stratospheric ozone are not anticipated.

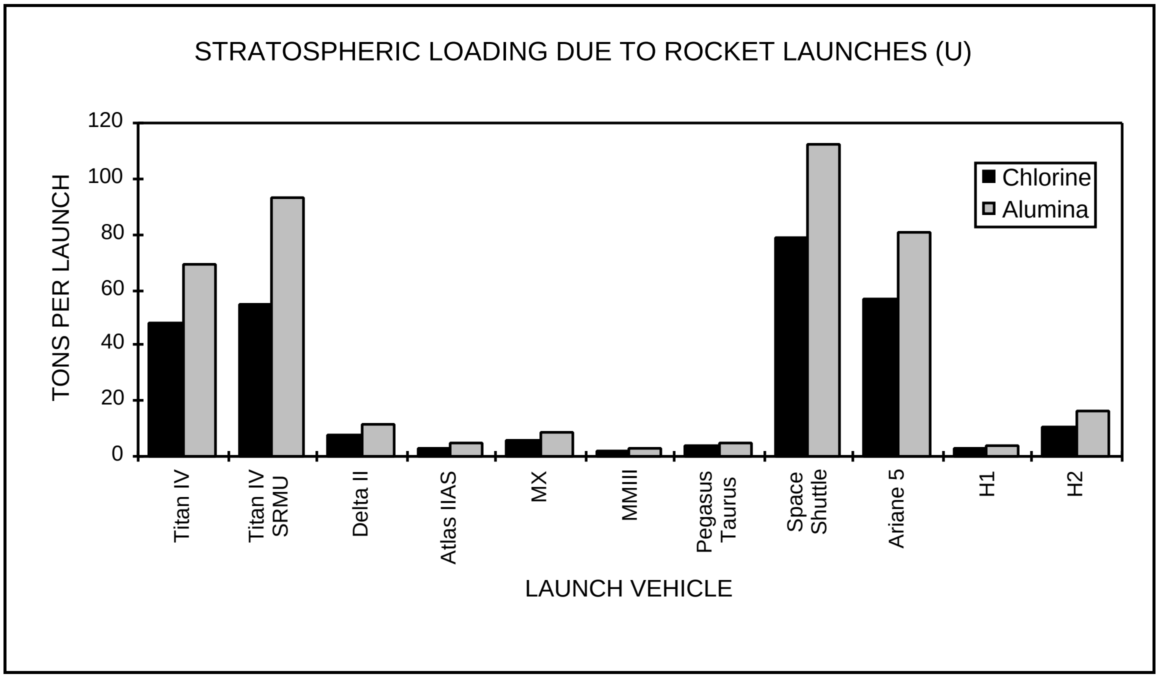

Figure 6 Stratospheric Loading Due to Rocket Launches

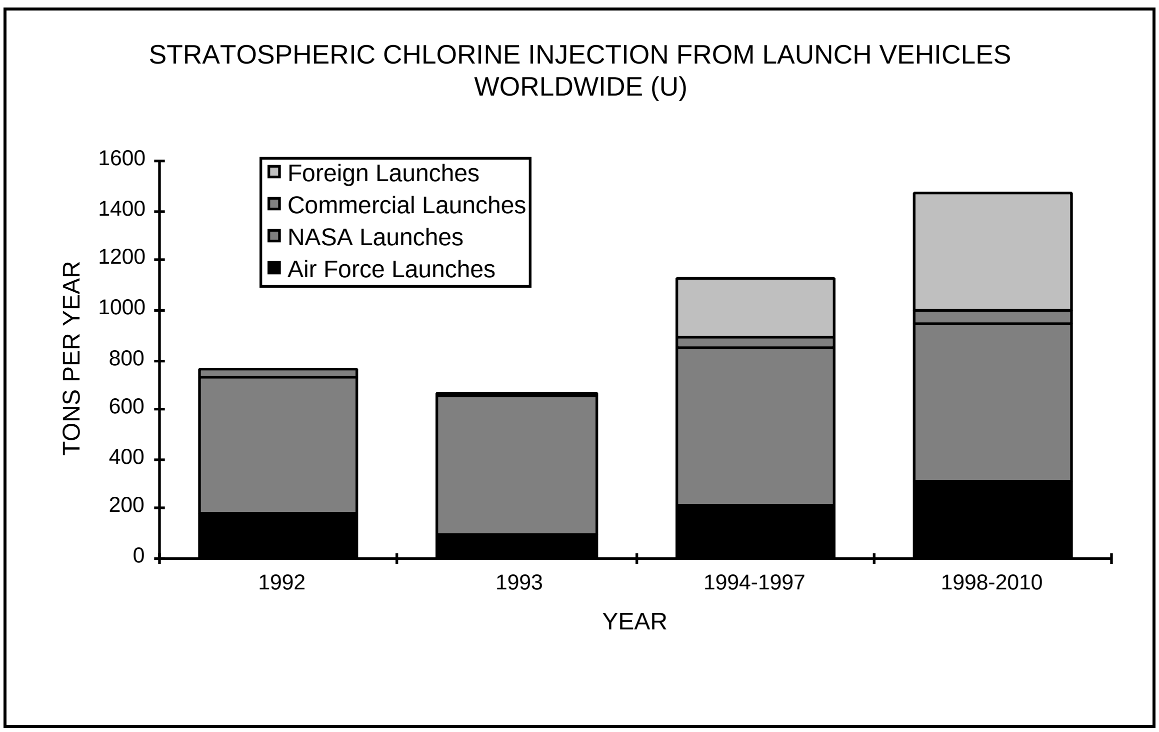

Figure 7 Stratospheric Chlorine Injection from Launch Vehicles Worldwide

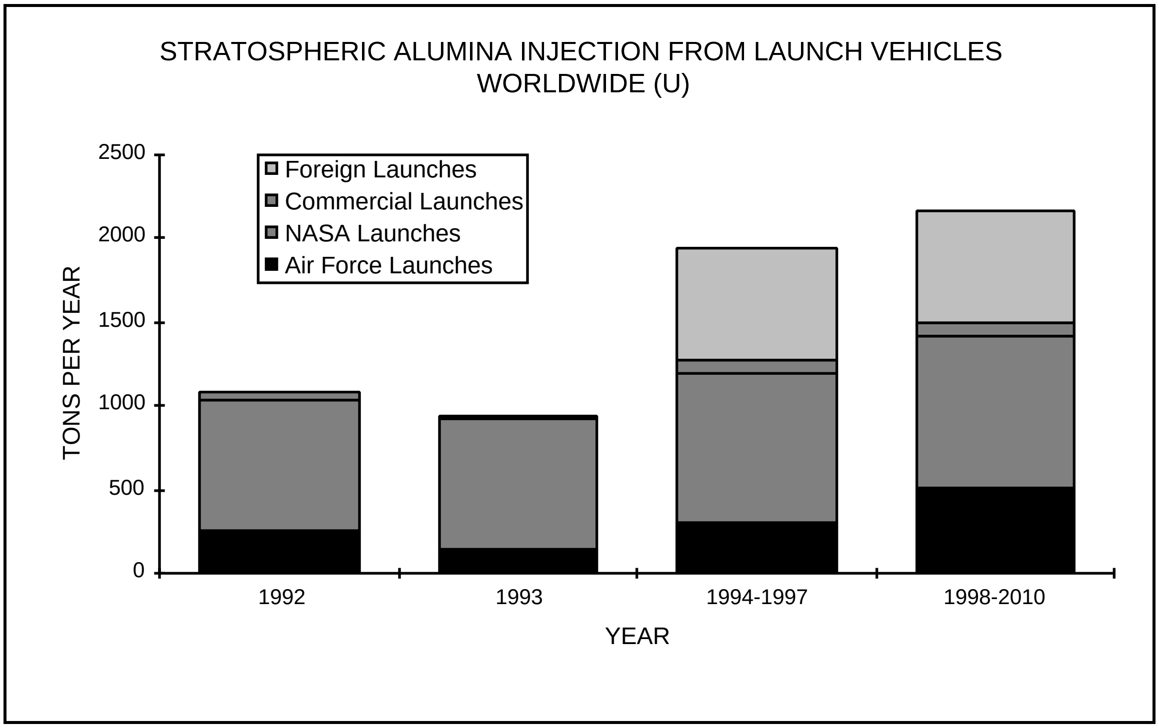

Figure 8 Stratospheric Alumina Injection from Launch Vehicles Worldwide

SECTION 5

REGULATORY REVIEW AND PERMIT REQUIREMENTS

This section discusses the regulatory requirements that may be applicable to the proposed and alternative action.

5.1 THREATENED AND ENDANGERED SPECIES

The federal Endangered Species Act (ESA) of 1973, as amended, extends legal protection to plants and animals listed as endangered or threatened by the USFWS. Section 7(c) of the ESA authorizes the USFWS to review proposed major federal actions to assess potential impacts on listed species. According to Section 7(c) of the ESA, the Air Force, in consultation with the USFWS, must identify potential species in areas of concern. If a previously closed launch complex is used for the EELV program, consultation with the USFWS by the EELV program will be required.

The ESA of 1973, as amended (16 USC 1531 et seq.), is intended to prevent the further decline of endangered and threatened plant and animal species and to help in the restoration of populations of these species and their habitats. The act, which is jointly administered by the Department of Commerce and the Department of the Interior, requires that each federal agency consult with the USFWS to determine whether endangered or threatened species are known to exist or have critical habitats on or in the vicinity of the site of a proposed action.

5.2 CULTURAL RESOURCES

Section 106 of the National Historic Preservation Act of 1966, as amended, requires federal agencies to consult with the SHPO and the federal Advisory Council on Historic Preservation (ACHP) if proposed undertakings would affect resources of state, local, or national significance. These resources are identified in the NRHP and are maintained by the U.S. Secretary of the Interior.

Through Section 106, a public interest process is established in which the federal agency proposing an undertaking participates along with the SHPO, the ACHP, interested organizations, and individuals. The process is designed to ensure that properties and the impacts on them are identified, and that alternatives to avoid or

mitigate an adverse effect on property eligible for the NRHP are adequately considered in the planning process. Consultation under Section 106 of the NRHP for the EELV program will be conducted as needed.

5.3 COASTAL ZONE MANAGEMENT

The Coastal Zone Management Act (CZMA) authorizes a state-federal partnership to ensure the protection of coastal resources. While Florida has specifically excluded federal facilities from the state's coastal zone, as required by Sections 305(b)(1) and 304(1) of the CZMA, the act requires that federal activities directly affecting the coastal zone and federal development projects located in or directly affecting the coastal area be consistent “to the maximum extent practicable” with the Florida Coastal Management Program (CMP). Therefore, the Florida CZMA requires consistency review of federal development projects and activities “. . . which significantly affect the coastal waters and the adjacent shorelands of the state” (380.23(3)(a), FS).

Of the Florida statutory authorities included in the CMP, impacts from satellite and LV processing in the areas of historic preservation (chapter 267), living land and freshwater resources (chapter 372), and environmental control (chapter 403) are addressed in this EA. The SBIRS program is consistent with the Florida CMP.

SECTION 6

PERSONS AND AGENCIES CONSULTED

The following individuals were consulted during preparation of this environmental assessment.

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Johnson Controls
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Mercadante, Mark
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SECTION 7

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